

M365-90



TECHNICAL MANUAL

OPERATING AND SERVICING INSTRUCTIONS

HIGH SPEED PRINTER

(MICROPROCESSOR-CONTROLLED LOGIC)

MODEL NUMBER HSP3609-212A

REVISED FEBRUARY 1984

MILTOPE
CORPORATION

1770 WALT WHITMAN ROAD • MELVILLE, NEW YORK 11747

SEPT 1979



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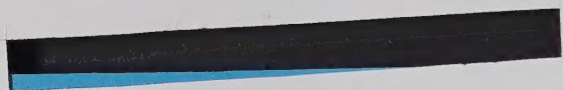


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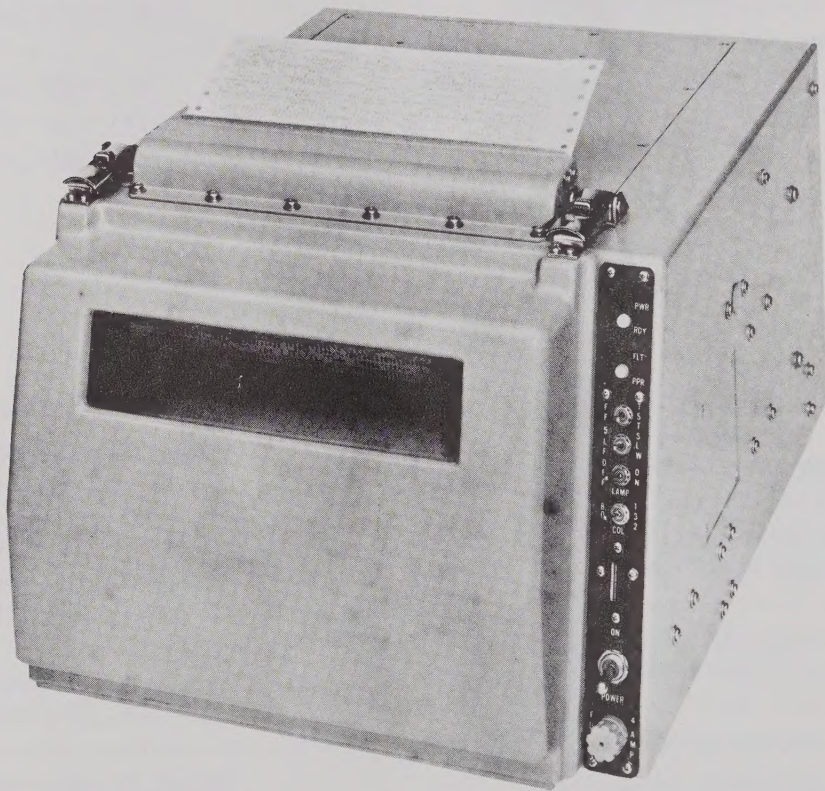


Figure 1-1. HSP3609-212A High Speed Printer

SECTION I INTRODUCTION

1-1. GENERAL

1-2. This technical manual covers the HSP3609-212A series of microprocessor-controlled high speed printers (figure 1-1), designed and manufactured by Miltope Corporation, Long Island, New York.

1-3. SCOPE OF MANUAL

1-4. This manual provides operating and servicing instructions for the basic High Speed Printer HSP3609-212A, hereinafter referred to as the printer, with differences in interface requirements, power inputs, and printer mechanical functions. This section of the manual contains introductory material, a general description of the printer, its purpose and capabilities, and a description of printer options. Section II describes unpacking and installation instructions and signal interface requirements. Section III provides operating instructions for the printer. Section IV describes the operation of the printer mechanical and electronic circuits. Section V contains preventive maintenance instructions, and Section VI provides maintenance instructions for testing, aligning, troubleshooting, and repair of the printer. Schematic diagrams of the printer are provided in Section VII.

1-5. DESCRIPTION

1-6. GENERAL. The printer is a microprocessor-controlled, high-speed, helix-impact printing device intended for use in military airborne, ground, and shipboard tactical communications systems. Data output is provided in the form of alpha-numeric, symbolic, and graphic characters selected in accordance with ASCII standards. Each character is dot-pattern printed on pressure-sensitive, sprocket-fed, foldout paper using a dot matrix to form each character. The printer incorporates built-in-test equipment (BITE) that is used to perform a printer self-test. Controls on the front panel provide all essential operator controllable functions. Power and signal connections are located on the rear of the printer.

1-7. MECHANICAL PRINTER ASSEMBLY. The mechanical printer assembly (figure 1-2) is constructed around two aluminum castings, designated the main frame and gate, respectively. Mounted to the main frame casting (16) are the hammer bank (5), paper feed stepping motor (17), paper feed pin wheels and rollers (14), top of form assembly (4), blower motor assembly (2) and rotor (3), motor starting capacitors (15), and helix wake-up control relay (1). Mounted to the gate casting (13) are the helix assembly (12), helix drive motor (10), timing gear (7), timing transducer (8), forms thickness cam (11) and control knob (9), and the paper out/gate open switch (6).

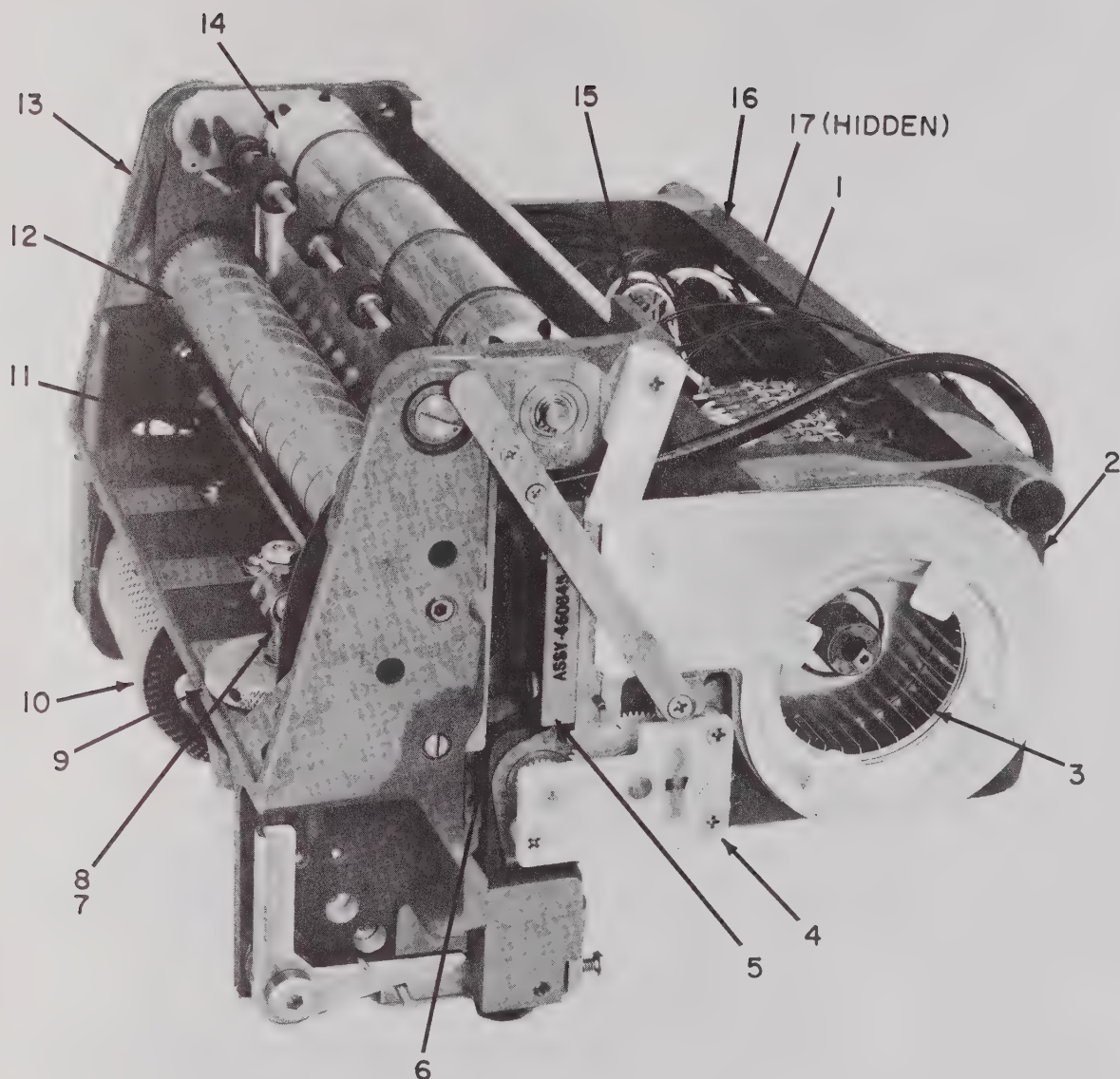
1-8. PRINT CONTROL PCB MODULE ASSEMBLY. The print control PCB module assembly contains a basic microcomputer used to process octal-encoded ASCII characters into dot-pattern characters, and to control operation of the mechanical printer.

1-9. INTERFACE PCB MODULE ASSEMBLY. The interface PCB module assembly contains the electronics to communicate with an external controller. Since interface requirements differ with specific applications, various interfaces are covered in this manual.

1-10. ENCLOSURE AND POWER SUPPLY ASSEMBLY. The enclosure and power supply assembly houses the mechanical printer assembly, power supply components, and print control PCB module assembly. Figure 1-3 shows a typical enclosure and power supply assembly designed for tabletop mounting with a 115-vac, 60-Hz, single-phase power supply. Contained within the enclosure (1) are power transformer (3), bridge rectifiers (5), RFI line filter (6), filter capacitors (2), (4), (7), and wiring harness (8).

1-11. PERFORMANCE DATA

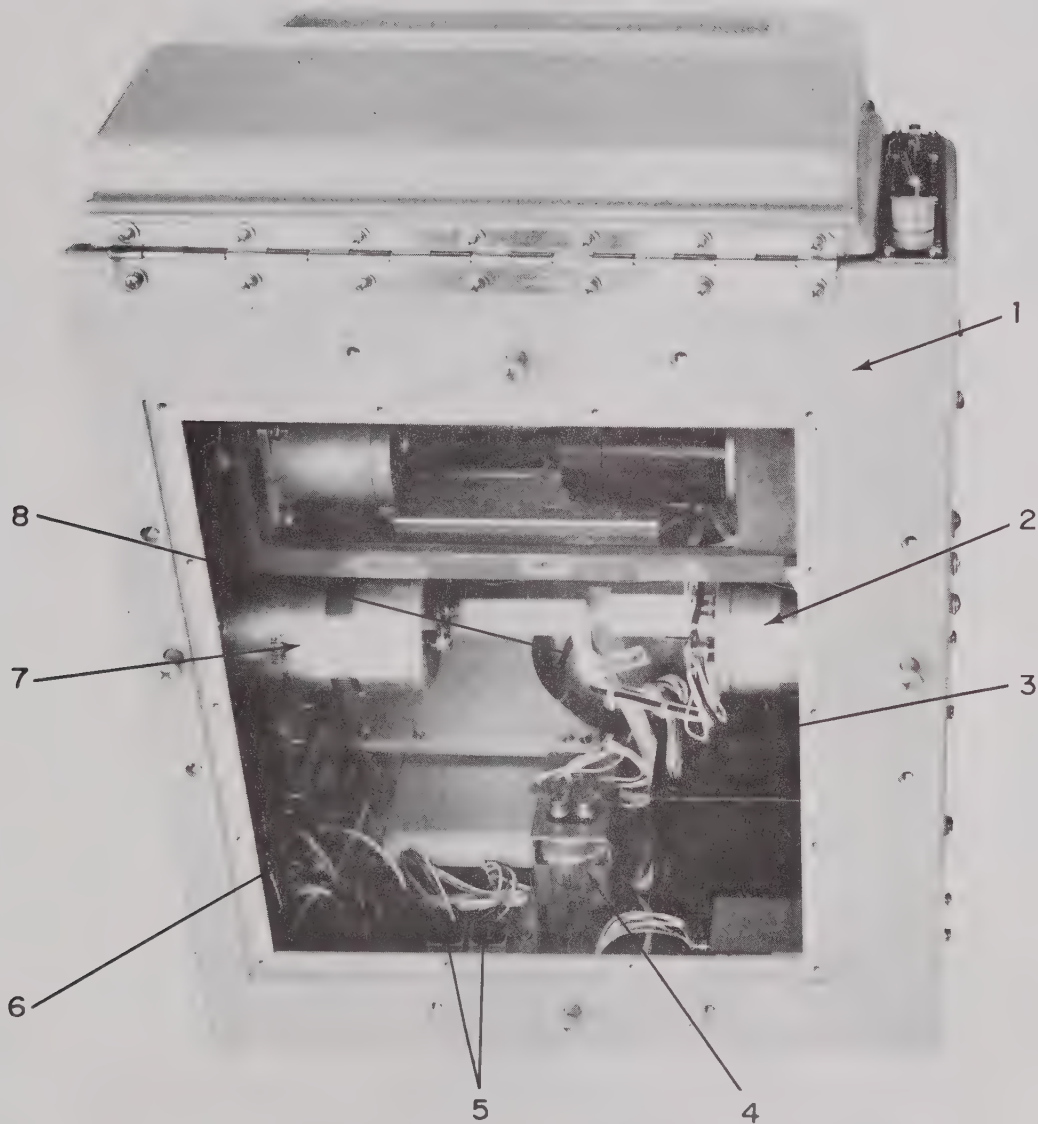
1-12. Table 1-1 lists the performance data for the printer.



LEGEND

- | | |
|--------------------------|------------------------------------|
| 1. Relay (Helix Wake Up) | 9. Forms Thickness Adjustment Knob |
| 2. Blower Motor Assembly | 10. Helix Drive Motor Assembly |
| 3. Blower Impeller | 11. Form Thickness Cam |
| 4. Top of Form Assembly | 12. Helix Assembly |
| 5. Hammer Bank | 13. Gate Casting |
| 6. Paper Out Switch | 14. Paper Drive Wheel Assembly |
| 7. Timing Gear | 15. Motor Starting Capacitor |
| 8. Transducer | 16. Main Frame Casting |
| | 17. Paper Feed Stepping Motor |

Figure 1-2. Mechanical Printer Assembly



LEGEND

- | | |
|----------------------|----------------------|
| 1. Printer Enclosure | 5. Bridge Rectifiers |
| 2. Filter Capacitor | 6. RFI Filter |
| 3. Power Transformer | 7. Filter Capacitor |
| 4. Filter Capacitor | 8. Wiring Harness |

Figure 1-3. Typical Enclosure and Power Supply Assembly

Table 1-1. Performance Data

ITEM	SPECIFICATIONS
<u>Mechanical</u>	
Print Speed	400LPM - 80 columns (nominal) 240LPM - 132 columns (nominal)
Characters per line	80 Standard, 132 optional
Column Spacing	10 characters/inch - 80 column 17 characters/inch - 132 column
Line Spacing	6 lines/inch
Character Size	.07" wide x .125" high nominal, 80 columns .044" wide x .125" high nominal, 132 columns
Character Set	Standard: 96 character ASCII subset Optional: 64 standard ASCII (graphic set optional) Optional: 128 character ASCII subset
Number of Copies	Original plus two
Forms	Pressure sensitive, fanfold, sprocket fed, 9-3/8" wide x 11" long (Miltop P/N 461024)
Forms Supply Capacity	400 sheets (fanfold)
<u>Electrical</u>	
Buffer Storage	Full line (80 or 132 characters)
Data Input Code	ASCII
Interface	TTL Single-Ended ROLM 3330 (UYK19/20 Compatible) RS232 Serial NTDS Fast Interface (UYK-20 Compatible)
Primary Power	115VAC, 50 Hz, 1Ø 115VAC, 60 Hz, 1Ø 115VAC, 400 Hz, 1Ø 115VAC, 47-440 Hz, 1Ø 220VAC, 50 Hz, 1Ø 208VAC, 400 Hz, 3Ø wye 28VDC
Power Consumption	Idling 75 watts Printing - 250 watts nominal
<u>Environmental</u>	
Operating Temperature	-54 ⁰ to +55 ⁰ C (+71 ⁰ C intermittent)
Humidity	100% up to 29.5 ⁰ C

Table 1-1. Performance Data (Cont.)

ITEM	SPECIFICATIONS
Shock	20 g's, 1/2 sine, 11ms
Vibration	MIL-E-5400 curve III A
Physical	
Size	14.00 wide x 9.50 high x 19.00 deep
Weight	65 lbs (approx.)

SECTION II INSTALLATION

2-1. GENERAL

2-2. This section contains instructions for unpacking, inspection, and installation of the printer. Interface and input power interconnections are also included.

2-3. PACKAGING DATA

2-4. The printer is packed in a wooden crate which is lined with sufficient cushioning material to protect the equipment during shipment. The printer is shipped with a packing list attached to the outside of the crate or enclosed inside the crate. The packing list should be used to check the contents of the crate during unpacking.

2-5. INSPECTION

2-6. The printer should be inspected, both as a packaged unit and after unpacking, for any signs of shipping damage (dents, breaks, water moisture damage), or any evidence of general mishandling. If any damage is disclosed, file a complaint with the carrier, noting all damage, and notify Miltope Corporation of such action.

2-7. UNPACKING

2-8. To unpack the printer, proceed as follows:

1. Position the crate so that the shipping labels on sides of the crate are facing upward.

2. Remove the top of the wooden crate and remove the top layer of foam and four side cushions that support the printer.

3. Lift the printer out of the crate and remove from the plastic container.

2-9. INSTALLATION

2-10. The printer can be fixed mounted to a desk or table top. It can also be installed in a standard 19-inch electronic cabinet (with the addition of mounting flanges and slides mounted on the printer cabinet by Miltope prior to shipment).

2-11. **FIXED MOUNTING (FIGURE 2-1).** To fix mount the printer, perform the following:

1. On printer mounting surface, drill 12 mounting holes. (See bottom view of printer in figure 2-1 for layout.) Holes must accommodate 1/4-inch diameter mounting screws.

2. Position printer over mounting holes and insert 1/4-20 mounting screws through the mounting holes. Thread each of the 12 mounting screws into a clinch-nut fastener.

3. Secure the printer to the mounting surface by tightening the mounting screws.

2-12. **RACK MOUNTING (FIGURE 2-2).** To install the printer in a standard 19-inch electronic cabinet, proceed as follows:

1. Locate the right mounting bracket on the right side of the printer with the three mounting screws aligned to the threaded holes in the printer case. The "L" flange fits under the printer base. (The right side bracket has fewer screw access holes than the left side bracket.)

2. Start the three screws and then tighten, taking care not to strip the threads.

3. Repeat steps 1 and 2 for the left mounting bracket.

4. Position the printer so that the lips of the two "L" brackets can be secured to the underside of the base with four screws.

5. Position the rack slides on the mounting brackets, one side at a time, and secure with six mounting screws each.

6. Position the printer rack slides in the equipment rack slide troughs. They must be firmly latched into position before releasing the printer.

7. Slide the printer in the equipment rack.

8. Position and thread eight Camloc fasteners into the equipment rack.

2-13. **INPUT POWER CONNECTIONS.** Tables 2-1 through 2-5 list the power connections for different input power sources.

2-14. **INTERFACE CONNECTIONS.** Tables 2-6 through 2-11 list the interface connections for various interface requirements.

2-15. **CONFIGURATIONS.** The various available configurations of the printer by model number are listed in table 2-12.

Table 2-1. Power Connector J1 Signal Listing
(115 VAC, 50 Hz, 115 VAC, 60 Hz, 1Ø, or
115 VAC, 47-440 Hz, 1Ø)

* PIN	SIGNAL DESCRIPTION
A	115 VAC High
B	115 VAC Low
C	Chassis Ground
D	Open
E	Open
*Connector - MS27508E14A5P Mate - MS27473E14A5S	

Table 2-4. Power Connector J1 Signal Listing
(208 VAC, 400 Hz, 3Ø)

* PIN	SIGNAL DESCRIPTION
A	Phase A
B	Phase B
C	Phase C
D	Neutral
E	Chassis Ground
*Connector - MS27508E14F5PD Mate - MS27473E14F5SD	

Table 2-2. Power Connector J1 Signal Listing
(115 VAC, 400 Hz, 1Ø)

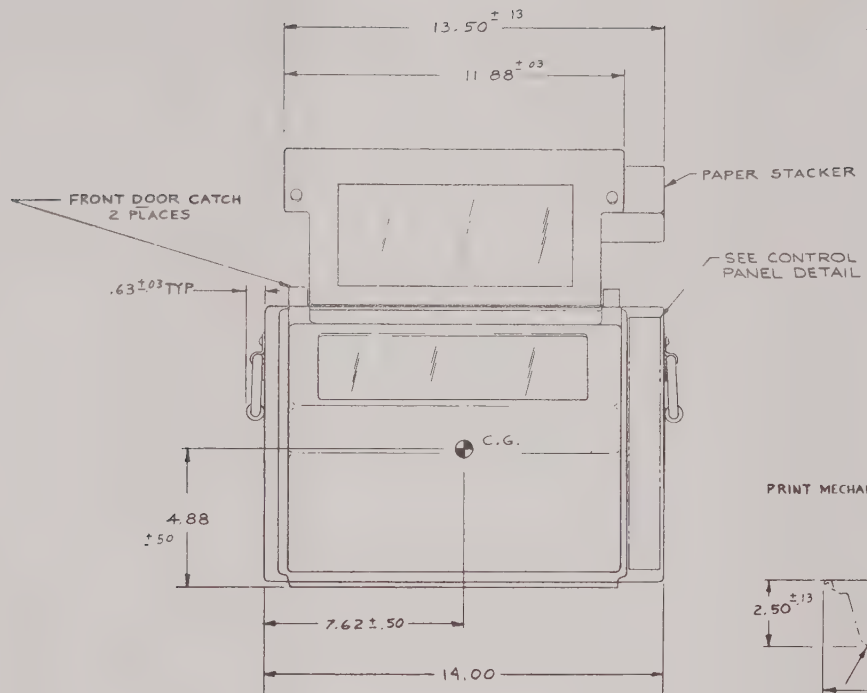
* PIN	SIGNAL DESCRIPTION
A	Open
B	Open
C	Chassis Ground
D	115 VAC High
E	115 VAC Low
*Connector - MS27508E14A5P Mate - MS27473E14A5S	

Table 2-5. Power Connector J1 Signal Listing
(28 VDC)

* PIN	SIGNAL DESCRIPTION
A	Positive
B	Negative
C	Chassis Ground
D	Open
E	Open
*Connector - MS27508E14F5PA Mate - MS27473E14F5SA	

Table 2-3. Power Connector J1 Signal Listing
(220 VAC, 50 Hz, 1Ø)

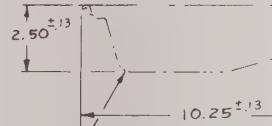
* PIN	SIGNAL DESCRIPTION
A	220 VAC High
B	Open
C	Chassis Ground
D	Open
E	220 VAC Low
*Connector - MS27508E14A5P Mate - MS27473E14A5S	



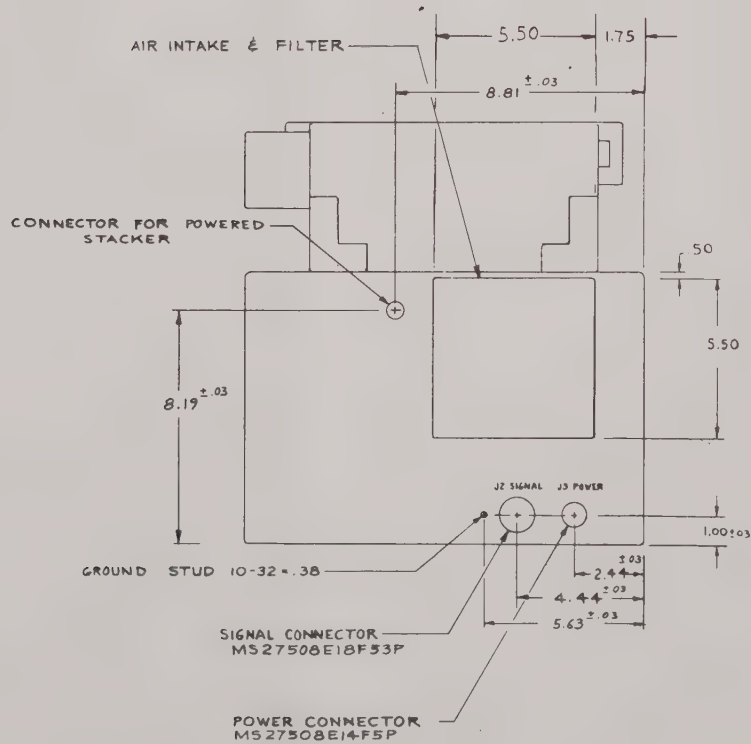
HELIX GATE IN
FOR LOADING

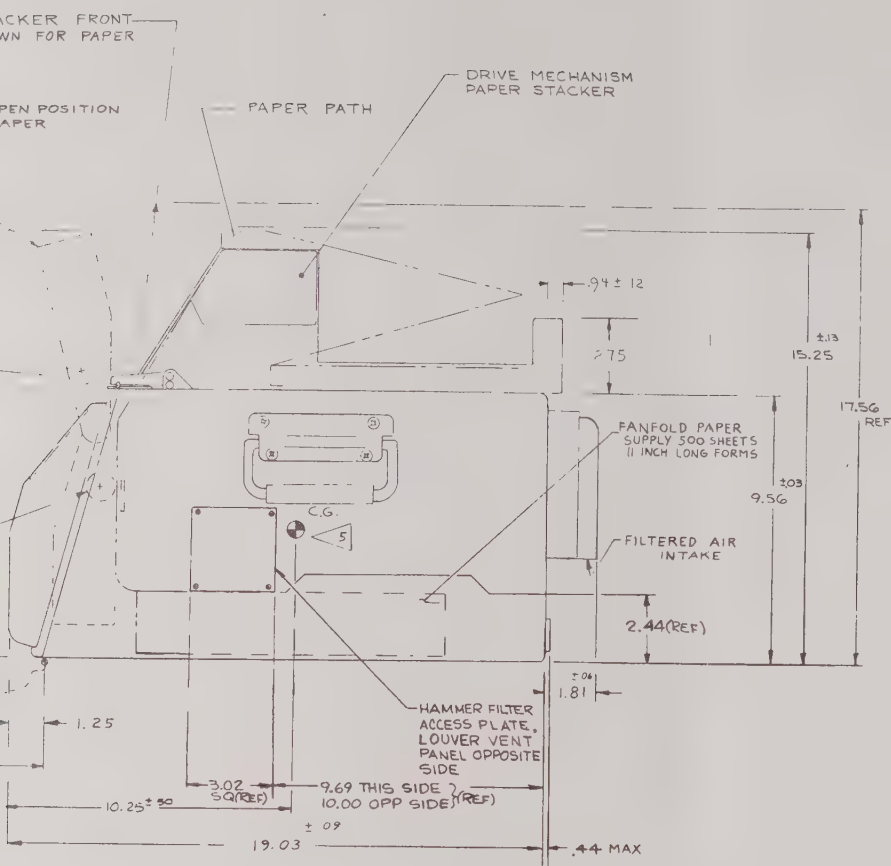
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PRINT MECHANISM



COVER IN OPEN POSITION
FOR LOADING PAPER





NOTES:

1. PRINTER EXCITATION: 115V, 60 HZ
2. POWER CONSUMPTION: (AT 600 LPM)
(EXCLUSIVE OF PAPER STACKER)
IDLING MODE 75 WATTS MAX
PRINTING MODE TBD WATTS MAX
3. PRINTER WEIGHT:
65 LBS (EXCLUDING STACKER)
4. MOUNTING POINTS FOR MIL-S-901 SHOCK MOUNTS (WHEN USED) RECOMMENDED SHOCK MOUNT AEROFLEX PART NO. C1260-39-C2 (4 REQD) OR EQUIVALENT.
5. CENTER OF GRAVITY SHOWN IS FOR PRINTER (EXCLUDING STACKER).

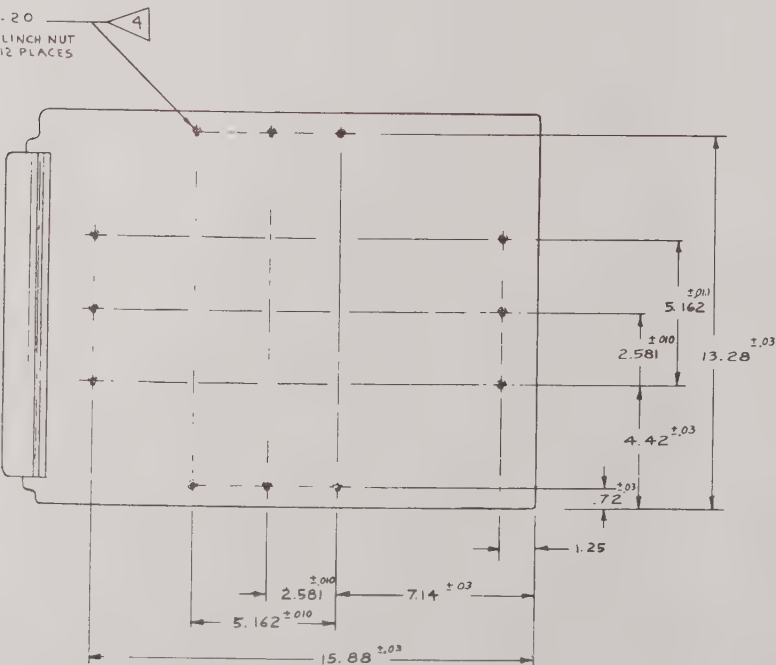
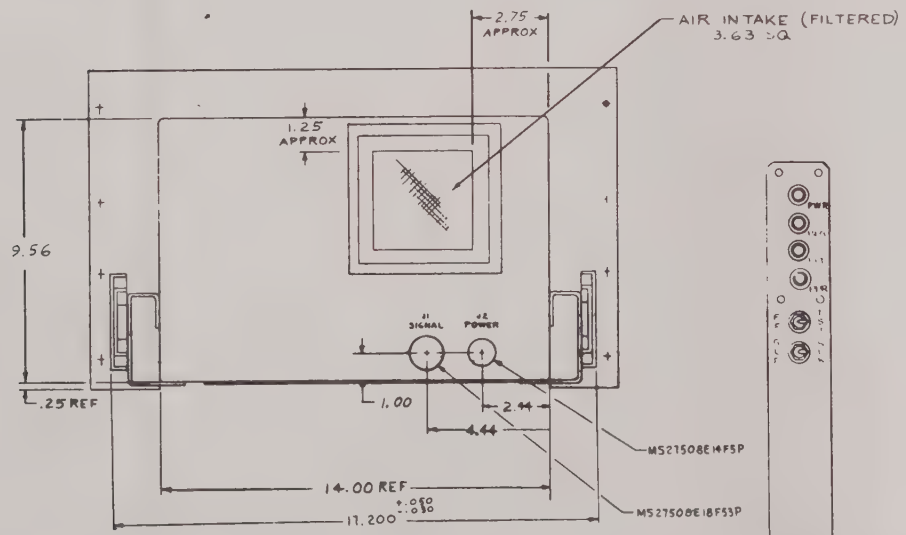
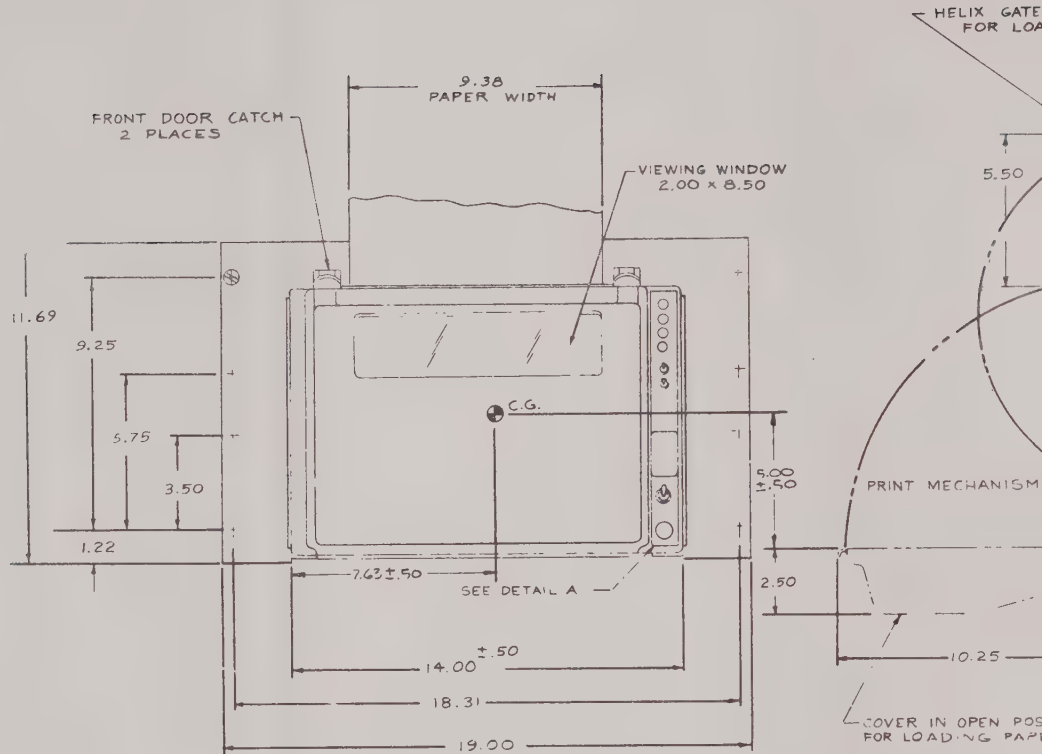
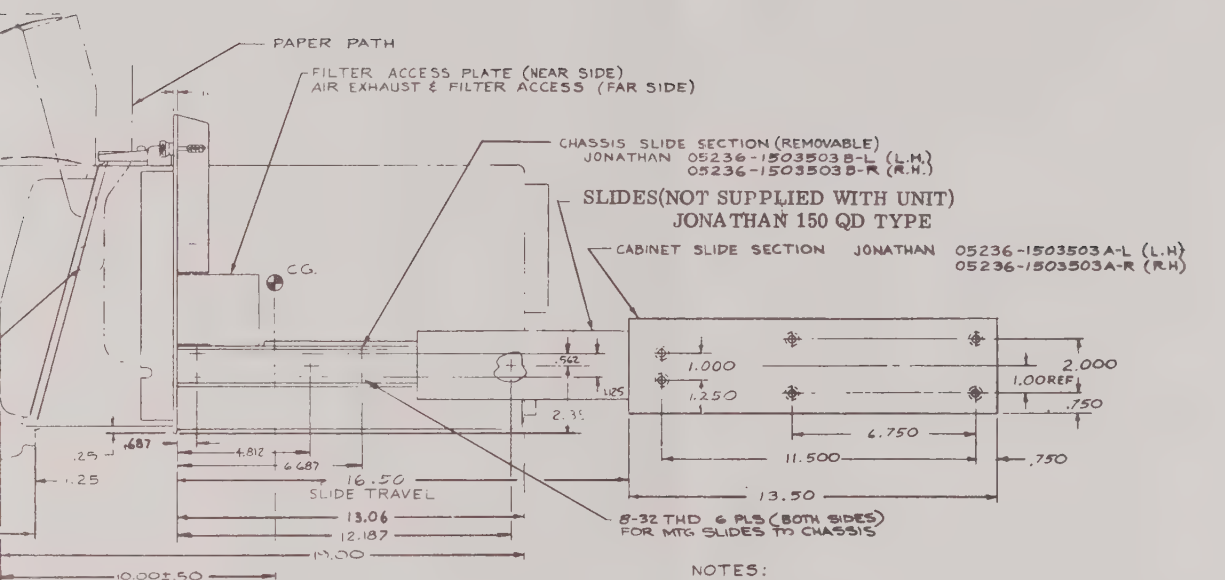


Figure 2-1. HSP3609-212A Table-Top Mounting with Powered Stacker (Typical), Outline Dimensions



DETAIL 'A'
SCALE 1:1

OPEN POSITION
PAPER



NOTES:

1. EXCITATION: 115 VAC, 60 HZ, 1 ϕ
2. HEATER EXCITATION (WHEN USED): 250 W. MAX.
3. PRINTER WEIGHT: 75 LBS
4. COOLING: BY INTERNAL FANS.
5. REMOVAL OF PRINTER FROM USER'S MOUNTING:
USE SLIDE QUICK-DISCONNECT FEATURE.

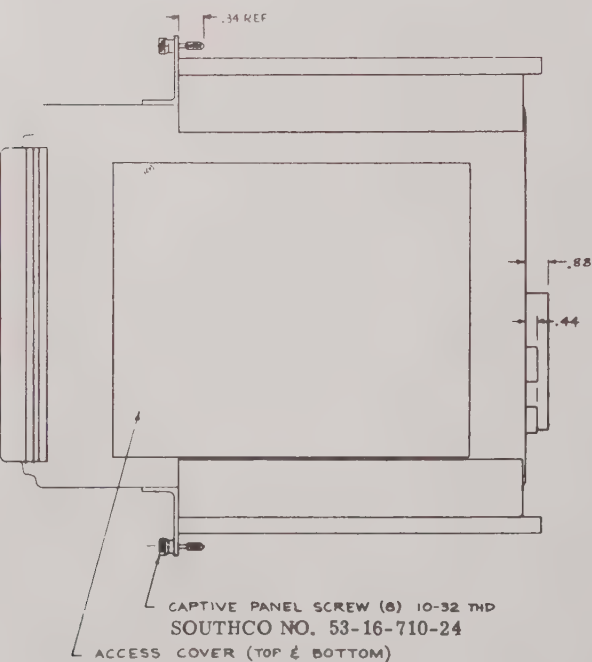
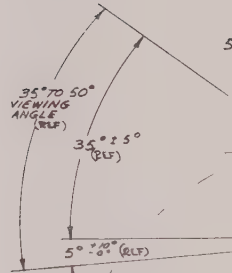
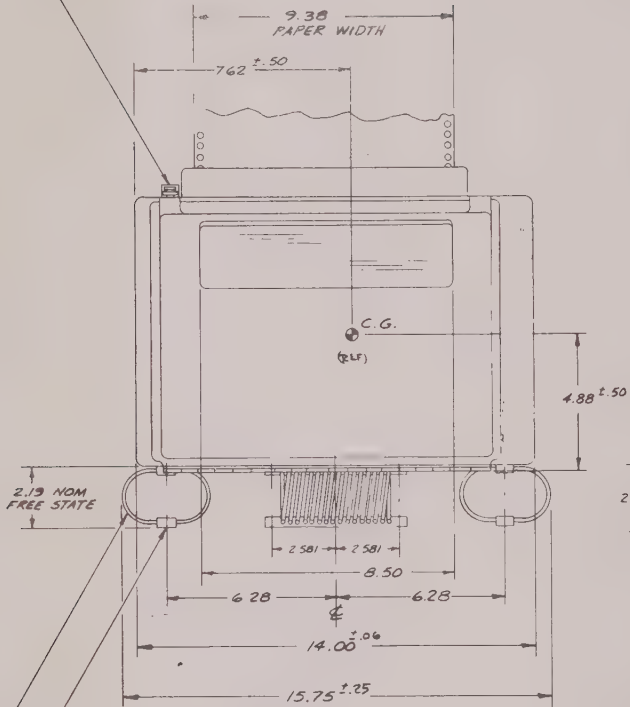
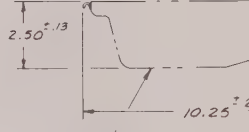


Figure 2-2. HSP3609-212A Rack Mounting without Stacker (Typical), Outline Dimensions

FRONT DOOR CATCH
(2 PLCS)



PRIN
MECHA

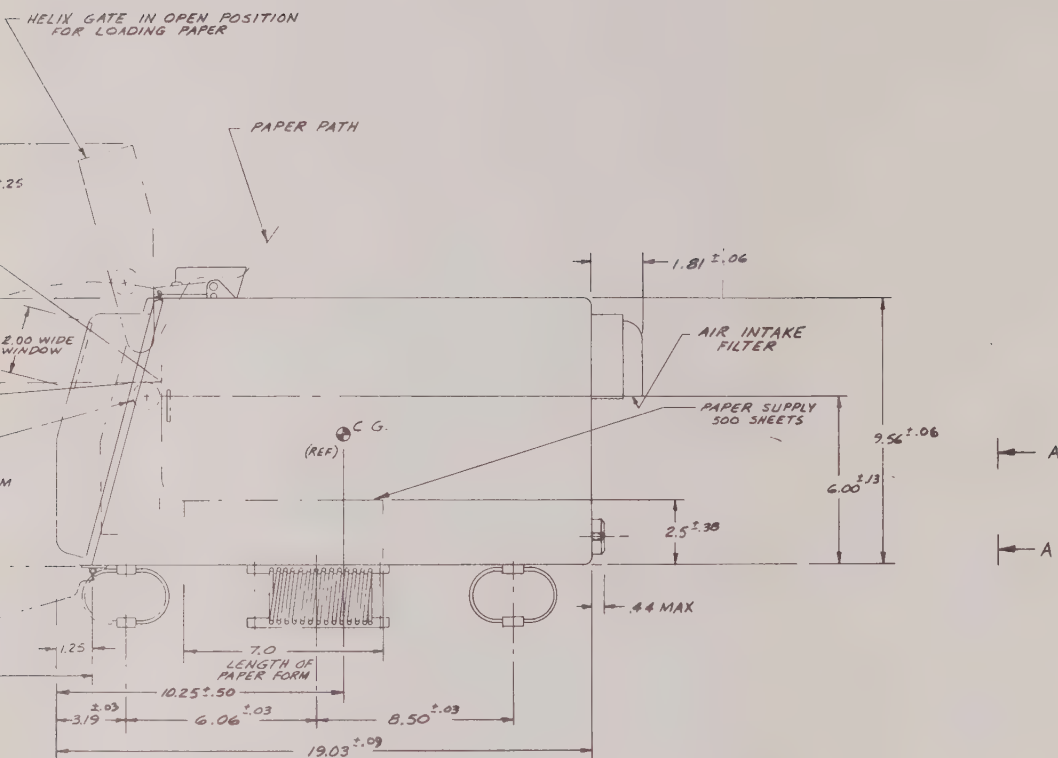


COVER IN OPEN
FOR LOADING

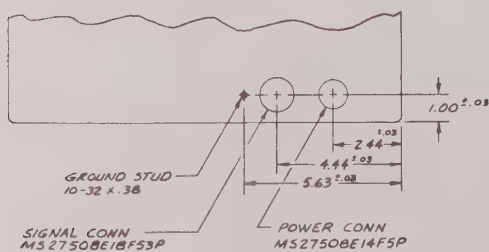
(3) $\frac{1}{4}$ -28 TAPPED MOUNTING HOLES
IN EACH SHOCK MOUNT

OPTIONAL SHOCK MOUNTS (AEROFLEX NO. C1260-39 C1) 4 PLCS
OR RUBBER FOOT MOUNTING





POSITION
PAPER

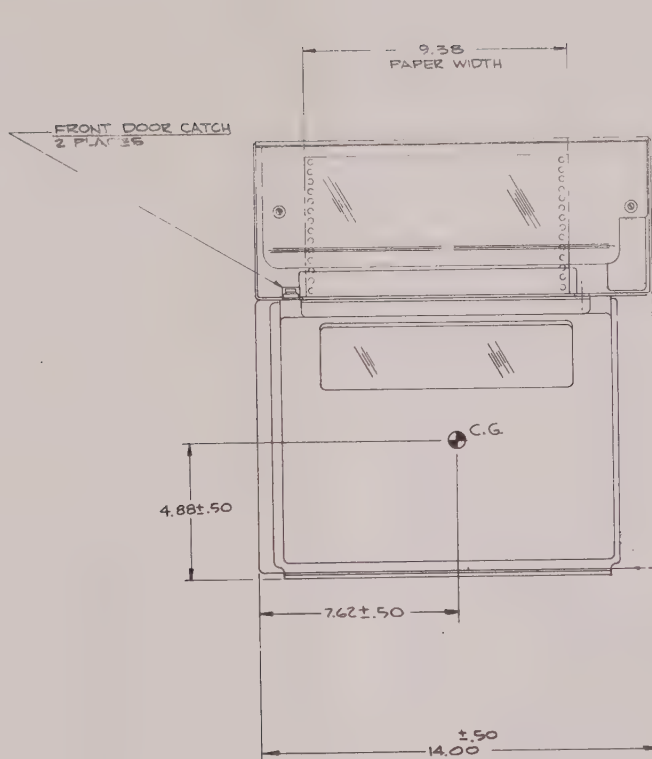


PARTIAL VIEW A-A

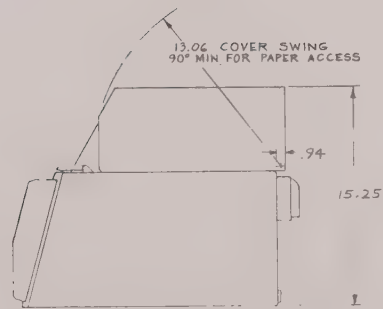
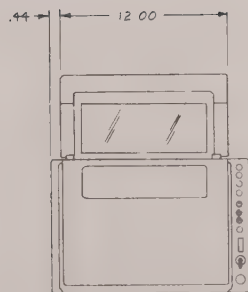
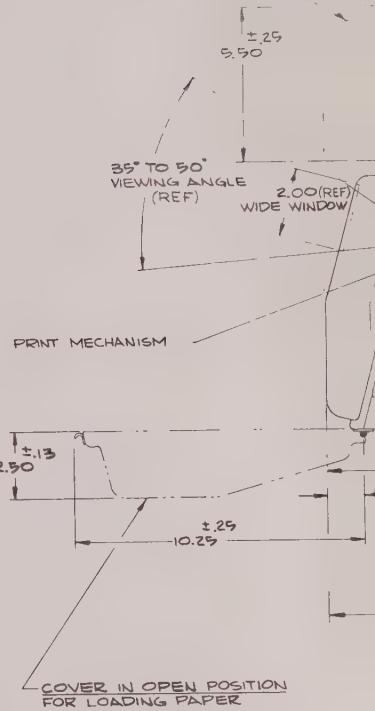
NOTES :

1. SHOCK MOUNTING SYSTEM TO PROVIDE ISOLATION TO THE PRINTER FROM MIL-5-901 GRADE A SHOCK INPUTS.
2. PRINTER EXCITATION : 115 VOLTS, 60 HZ, 1 ϕ
3. POWER CONSUMPTION:
IDLE MODE - 4.5 WATTS MAX.
PRINTING MODE - 210 WATTS MAX.
(AVG. TEXT)
4. PRINTER WEIGHT
70 LBS (INCL ISOLATION)

Figure 2-3. HSP3609-212A Table-Top Mounting without Stacker (Typical), Outline Dimensions



HELIX GATE IN OPEN POS
FOR LOADING PAPER



PAPER STACKER
(NON POWERED)

Table 2-6. TTL Single-Ended Interface Connector J2 Signal Listing

* PIN	SIGNAL DESCRIPTION
1	Signal Ground
2	Signal Ground
3	Data Bit 1
4	Ret
5	Data Bit 2
6	Ret
7	Data Bit 3
8	Ret
9	Data Bit 4
10	Ret
11	Data Bit 5
12	Ret
13	Data Bit 6
14	Ret
15	Data Bit 7
16	Ret
17	-Data Strobe) INVERSE
18	Ret
19	Spare
20	Spare
21	Spare
22	Spare
23	Spare
24	Ret
25	Ready
26	Ret
27	Spare
28	Spare
29-38	Spares
39-48	Shield Grids
*Connector - MS27508E18A53P Mate - MS27473E18F53S	

Table 2-7. ROLM 3330 (UYK19/28 Compatible) Interface Connector J2 Signal Listing

* PIN	SIGNAL DESCRIPTION
1	Spare
2	Data 7

Table 2-7. ROLM 3330 (UYK19/28 Compatible) Interface Connector J2 Signal Listing (Cont.)

* PIN	SIGNAL DESCRIPTION
3	Data 6
4	Data 5
5	D5 Rtn
6	Spare
7	D7 Rtn
8	D6 Rtn
9	Data 4
10	Data 3
11	D3 Rtn
12	Data 2
13	D2 Rtn
14	Data 1
15	D1 Rtn
16	D4 Rtn
17	Strobe
18	Strobe Rtn
19	Demand
20	Demand Rtn
21	Ready
22	Ready Rtn
23-53	Spare
*Connector - MS27508E18A53P Mate - MS27473E18F53S	

Table 2-8. Parallel RL-6 Compatible Interface Connector J2 Signal Listing

* PIN	SIGNAL DESCRIPTION
1	Signal Ground
2	Signal Ground
3	Data Channel 1
4	Rtn
5	Data Channel 2
6	Rtn
7	Data Channel 3
8	Rtn
9	Data Channel 4
10	Rtn
11	Data Channel 5

Table 2-8. Parallel RL-6 Compatible Interface
Connector J2 Signal Listing (Cont.)

* PIN	SIGNAL DESCRIPTION
12	Rtn
13	Data Channel 6
14	Rtn
15	Data Channel 7
16	Rtn
17	Data Strobe
18	Rtn
19	Reserved
20	Reserved
21	Reserved
22	Reserved
23	Spare
24	Spare
25	Demand (Ready)
26	Rtn
27	Reserved
28	Reserved
29	On-Line (Fault)
30	Rtn
31	96 Character NOT
32	Rtn
33	VFU NOT
34	Rtn
35	Interface Verify
36	Rtn
37-53	Spare
* Connector - MS27508E18A53P Mate - MS27473E18F53S	

Table 2-9. NTDS Fast Interface (UYK-20 Com-
patible) Connector J2 Signal Listing (Cont.)

* PIN	SIGNAL DESCRIPTION
6	Rtn
7	Data Bit 2
8	Rtn
9	Data Bit 3
10	Rtn
11	Data Bit 4
12	Rtn
13	Data Bit 5
14	Rtn
15	Data Bit 6
16	Rtn
17	ODA (Data Strobe)
18	ODA Rtn
19	IDA
20	IDA Rtn
21	EIR
22	EIR Rtn
23	Spare
24	Spare
25	ODR
26	ODR Rtn
27	Paper Alarm Bit (Input Data Bit 0)
28	Paper Alarm Bit Rtn
29-53	Spare
* Connector - MS27508E18A53P Mate - MS27473E18F53S	

Table 2-9. NTDS Fast Interface (UYK-20 Com-
patible) Connector J2 Signal Listing

* PIN	SIGNAL DESCRIPTION
1	Signal Ground
2	Signal Ground
3	Data Bit 0
4	Rtn
5	Data Bit 1

Table 2-10. PDP-11M Compatible Interface
Connector J2 Signal Listing

* PIN	SIGNAL DESCRIPTION
1	Signal Ground
2	Signal Ground
3	Data Bit 0H
4	Data Bit 0L
5	Data Bit 1H
6	Data Bit 1L

Table 2-10. PDP-11M Compatible Interface
Connector J2 Signal Listing (Cont.)

*PIN	SIGNAL DESCRIPTION
7	Data Bit 2H
8	Data Bit 2L
9	Data Bit 3H
10	Data Bit 3L
11	Data Bit 4H
12	Data Bit 4L
13	Data Bit 5H
14	Data Bit 5L
15	Data Bit 6H
16	Data Bit 6L
17	Data Strobe H
18	Data Strobe L
19	Spare
20	Spare
21	Spare
22	Spare
23	Parity Error H
24	Parity Error L
25	Ready H
26	Ready L
27	Spare
28	Spare
29	Spare
30	Spare
31	Initialize H (Clear Buff (Clear Buffer)
32	Initialize L
33	Data Bit 7 L (Parity)
34	Data Bit 7 H
35	Demand H
36	Demand L
37	Spare
38	Spare
39	Chassis Ground
40	Chassis Ground
41-66	Spare
*Connector - MS27508E18A53P Mate - MS27473E18F53S	

Table 2-11. RS232 Serial Interface Connector
J2 Signal Listing

*PIN	SIGNAL DESCRIPTION
5	Clear-to-Send
6	Rtn
7	Transmitted Data
8	Rtn
10, 12	Ground
*Connector - MS27508E18A53P Mate - MS27473E18F53S	

Table 2-12. Printer Configurations

MODEL NO.	PRIMARY POWER	INTERFACE	MOUNTING	COLUMNS	NOMENCLATURE
X32018	60Hz, 115V, 1 ϕ	Parallel Sgl Ended	Table-Top	80 only	RP-248/U NSN 6625011000306
X32049	60Hz, 115V, 1 ϕ	RL-6 Parallel	Rack	80/132	
X32054	400Hz, 208V, 3 ϕ	Special Parallel	Special Rack	80/132	TT-735/TYQ
X32059	400Hz, 115V, 1 ϕ	Rolm 3330 Parallel	Rack (11.69)	80/132	
X32066	60Hz, 115V, 1 ϕ	RS232 Serial	Rack	80 only	RP265/UYQ NSN 5895010853437
X32088	60Hz, 115V, 1 ϕ or 50Hz, 220V	RS232 Serial	Table-Top	80 only	
X32093	60Hz, 115V, 1 ϕ	Rolm 3330 Parallel	Rack	80 only	
X32095	28VDC	Special Parallel	Special Rack	80 only	TT-768/TYC-39 NSN 5805011202928
X32117	47-440Hz, 115V 1 ϕ	NTDS	Table-Top	80/132	RP258/TYC
X32120	400Hz, 115V, 1 ϕ	NTDS	Table-Top	80/132	
X32129	400Hz, 208V, 3 ϕ	TTL Parallel	Special Rack	80/132 & Plot	
X32152	60Hz, 115V, 1 ϕ	RS232 Serial	Rack	80/132	
X32158	60Hz, 115V 1 ϕ	Rolm 3330 Parallel	Rack	80 only	
X32160	60Hz, 115V, 1 ϕ	TTL Parallel	Table-Top	80 only	RP-248/U(A)
X32168	60Hz, 115V, 1 ϕ or 50Hz, 220V	RS232 Serial	Table-Top	80 only	
X32169	60Hz, 115V, 1 ϕ	ANew	Table-Top	80 only 600 LPM	

Table 2-12. Printer Configurations (Cont'd)

MODEL NO.	PRIMARY POWER	INTERFACE	MOUNTING	COLUMNS	NOMENCLATURE
X32183	60Hz, 115V, 1 ϕ	Rolm 3330 Parallel	Table-Top	80/132	RP-218A/A NSN 1560ND050877HAW
X32190	400Hz, 115V, 1 ϕ	Special Parallel	Special Rack	80 only	
X32203	400Hz, 115V, 1 ϕ	RS232 Ser. (9600)	Rack	80/132	
X32212	47-440Hz, 115V 1 ϕ	RS232 Ser. (9600)	Rack	80/132	
X32214	400Hz, 115V, 1 ϕ	MIL-STD- 188C	Special Rack	80 only	
X32220	400Hz, 115V, 1 ϕ	Rolm 3330 Parallel	Table-Top	80 only	
X32222	60Hz, 115V, 1 ϕ	RS232 Serial	Rack	80/132	RP-265/U YA
X32228	47-440Hz, 115V 1 ϕ	RS232 Ser. (9600)	Rack (12.25)	80/132	
SX32232	60Hz, 115V, 1 ϕ	NTDS (Modified)	Special Rack	132 only	
X32236	400Hz, 115V, 1 ϕ	Rolm 3370	Table-Top	80 & Plot	TT-801 NSN 7025011187678
X32238	60Hz, 115V, 1 ϕ	RS232	Table-Top	80 only	
X32246	60Hz, 115V, 1 ϕ	Parallel (Sgl End)	Table-Top	80 only	
X32247	60Hz, 115V, 1 ϕ	PDP-11M Dual-Diff	Table-Top	80/132	
X32248	50/60 Hz, 240V 1 ϕ	RS232 (9600)	Table-Top	80/132	
X32253	50/60Hz, 115V 1 ϕ	Rolm 3330	Special Rack	80 only	
X32264	60Hz, 115V, 1 ϕ	Rolm 3330	Rack	80 & Plot	

Table 2-12. Printer Configurations (Cont'd)

MODEL NO.	PRIMARY POWER	INTERFACE	MOUNTING	COLUMNS	NOMENCLATURE
X32267	400Hz, 115V, 1 ϕ	NTDS FAST	Rack	80/132	NSN 7025010059948
X32277	400Hz, 208V, 3 ϕ	Rolm 3370	Rack (11.69)	80/132	
X32280	60Hz, 115V, 1 ϕ	RS232 (4800)	Table-Top	80/132 & Plot	
X32287	50Hz, 220V	RS232 (4800)	Table-Top	80, Plot & Hebrew	
X32288	60Hz, 115V, 1 ϕ	NTDS FAST	Rack Special	80 only & Graphics	
X32293	47-440Hz, 115V, 1 ϕ	PDP-11M Dual-Diff	Rack (12.25)	80/132	
X32302	47-440Hz, 115V, 1 ϕ	NTDS FAST	Table-Top	80/132 & Plot & Graphics	
X32315	400Hz, 115V, 1 ϕ	RS232 (9600)	Rack (11.69)	80/132 & Plot & Graphics	
X32330	60Hz, 115V, 1 ϕ	NTDS FAST	Table-Top	80/132 & Plot	
X32332	28 VDC	RS232 (4800)	Table-Top	80/132	
X32340	47-440Hz, 115/ 230V, 1 ϕ	-188C (4800)	Table-Top	80 only	
X32343	47-440Hz, 115V 1 ϕ	RS232 (9600)	Rack	80/132	
SX32344	60Hz, 115V, 1 ϕ	RS232 (9600)	Special Rack	132 only	
X32351	60Hz, 115V, 1 ϕ	NTDS FAST/ SLOW	Table-Top	80/132 & Plot	
X32341	47-63Hz, 120V 1 ϕ	Rolm 3330	Table-Top	80 & Plot	
X32374	400Hz, 115V, 1 ϕ	RS232 (4800)	Rack (11.69)	80/132	
X32376	60Hz, 115V, 1 ϕ	Rolm 3330	Rack (12.25)	80/132	

SECTION III OPERATING INSTRUCTIONS

3-1. GENERAL

3-2. This section provides instructions for operating the printer. The instructions include a description of printer controls and indicators, paper loading, and general operating instructions.

3-3. CONTROLS AND INDICATORS

3-4. Figure 3-1 shows typical controls and indicators for operation of the printer. The function of each control and indicator is listed in table 3-1. Table 3-1 also lists the function of the internal forms thickness control shown in figure 3-2.

3-5. PAPER LOADING

3-6. To load paper into the printer, proceed as follows:

1. Set POWER switch to ON.
2. Set 5 LF/SLW switch to SLW and feed remaining paper from printer.
3. Set FF/TST switch to FF.
4. Release the two front cover toggle latches and open the front cover.
5. Release the two gate latches by pulling forward.
6. Pivot the gate outward and upward until the stay-bar drops in place; then release gate.
7. Open paper box door.
8. Using pressure sensitive paper (Miltape P/N 461024), slide a stack of 400 sheets (maximum) of single-ply paper into the paper supply bin beneath the mechanism. Allow one sheet to hang out of the bin as a threading leader.

Note

One side of the paper is more sensitive than the other. The most sensitive side should face outward when loaded properly. Scratching the paper with a fingernail will cause an obvious image on the sensitive side of the paper.

9. Fold the leading edge of the paper into a point and insert between the gate and lower paper feed roller as shown in figure 3-3.

10. Thread the paper up and out through the paper exit slot guide.

11. Pull paper upward until a fold aligns (may be approximate) with the under-line on the forms alignment decal.

12. While maintaining tension on the paper by gently pulling upward, guide the perforations along each side of the paper onto the sprocket pins.

13. Close the paper supply bin door.

14. Release the gate stay bar; lower the gate and push home so that the latches snap into place.

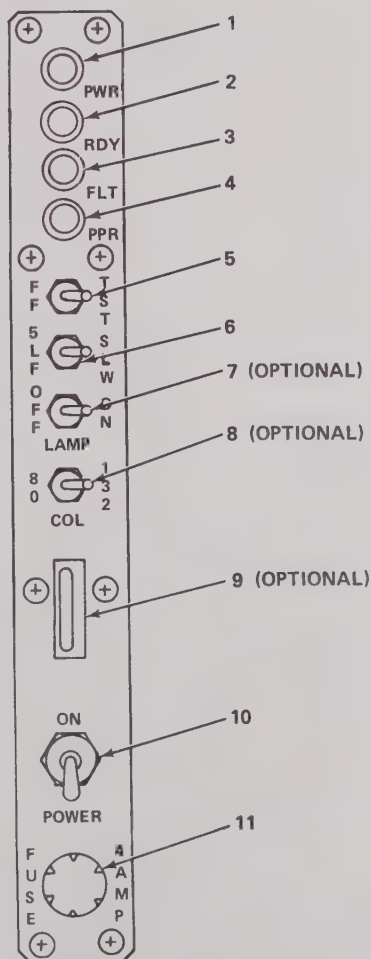


Figure 3-1. Typical Printer Control Panel

Table 3-1. Controls and Indicators

CONTROL OR INDICATOR	FIGURE 3-1 INDEX NO.	FUNCTION
PWR Indicator	1	When on indicates that primary power is being applied to the printer.
RDY Indicator	2	When on, indicates printer is ready to accept data.
FLT Indicator	3	When on, indicates one of the following conditions: a. Paper out b. Gate open
PPR Indicator	4	When on, indicates that 20 to 40 sheets of paper remain in the upper supply bin.
FF/TST switch	5	Actuating switch right (TST) causes a test pattern - the full character complement to be printed. Actuating switch left (FF) causes forms to advance to a top of form position (the start of a new form).
5LF/SLW switch	6	Actuating switch right (SLW) causes forms to slew. Releasing switch will stop slew. Actuating switch left (5LF) causes to advance 5 lines. Releasing switch will cause forms to return to their initial position.
LAMP ON-OFF switch (Optional)	7	Controls power to light printout illumination lamp.
Col. 80-132 switch (Optional)	8	Selects 80 or 132 column operation.
Elapsed Time Indicator (Optional)	9	Records operating time of the printer.
POWER ON switch	10	Provides primary power control to the printer.
FUSE-4AMP (Optional 8 AMP for 28 VDC power)	11	Provides protection to the printer.
FORM THICKNESS adjustment	-	
THICK (CCW)		Adjust helix for thicker paper forms.
THIN (CW)		Adjust helix for thinner paper forms.

Note

When optional paper takeup module is used, proceed as follows:

15. Release fasteners on takeup cover and open.

16. Insert tip of the folded paper into the slot on the tubular paper core. Manually rotate the core and wind 1 to 2 turns of paper.

3-7. OPERATION

3-8. With paper loaded and the printer and paper take-up properly connected to primary power and signal lines, operate the printer and perform the following adjustments:

1. Set POWER switch to ON. PWR and RDY indicators light; FLT and PPR indicators remain off.

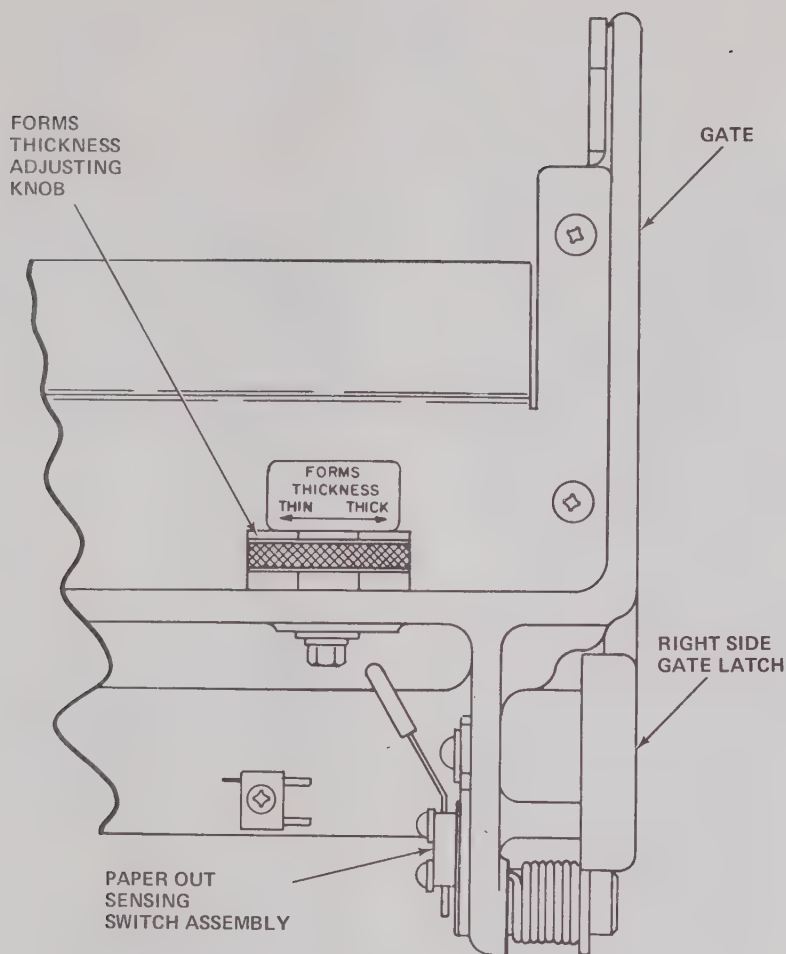


Figure 3-2. Forms Thickness Control

2. Activate FF/TST switch right to TST, causing the test pattern to be printed out.

Note

Once adjustment is made, readjustment should be infrequent.

3. If test pattern has excessive background shading, rotate FORMS THICKNESS knob (figure 3-2) toward THICK (CCW). Reset by activating FF/TST switch to TST. Check printout. Repeat until satisfactory pattern is obtained.

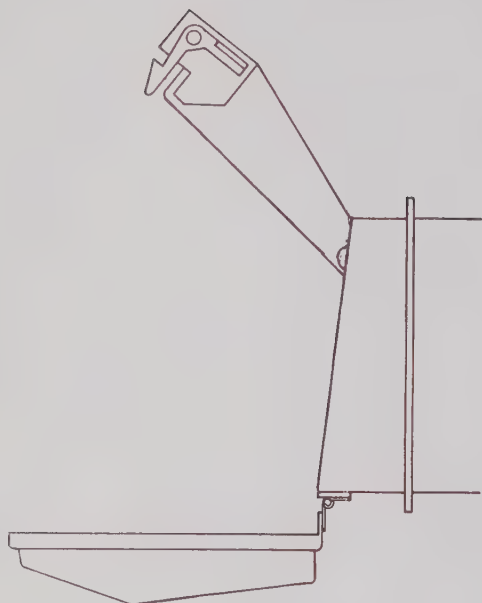
4. If test pattern has dots missing, rotate FORMS THICKNESS knob (figure 3-2) toward THIN (CW). Reset by activating FF/TST switch to TST.

Check printout. Repeat until satisfactory pattern is obtained.

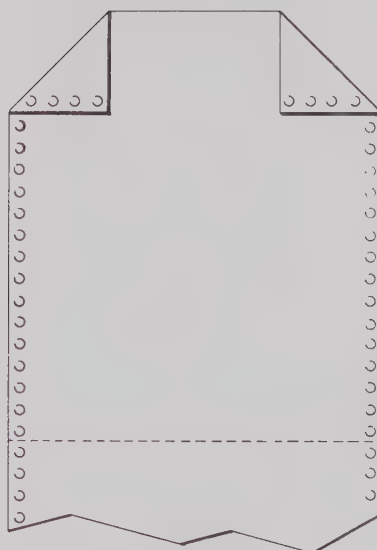
5. Observe the front panel status indicators for the following conditions:

- a. PWR - On
- b. RDY - On
- c. FLT - Off
- d. PPR - Off

6. The printer is now ready for on-line operation.

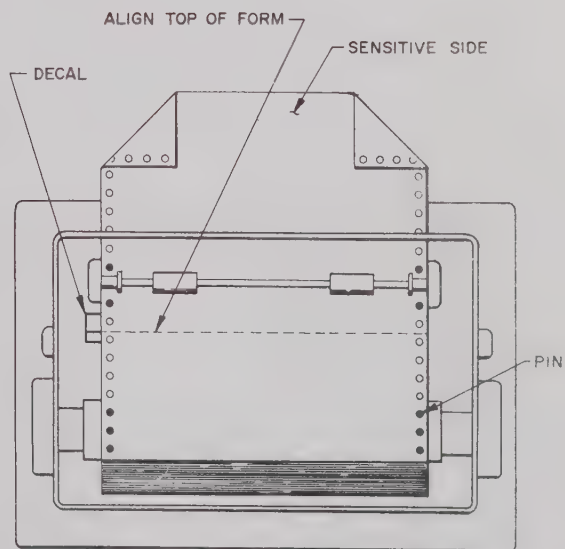


LEFT SIDE VIEW



PAPER FOLDING

- STEP 1. WITH POWER SWITCH SET TO ON, MOMENTARY HOLD FF/TST SWITCH IN FF.
- STEP 2. UNLATCH GATE AND LIFT. GATE UNTIL STAY BAR ENGAGES.
- STEP 3. SLIDE PAPER INTO PAPER BOX.
- STEP 4. SHUT PAPER BOX DOOR LEAVING TWO SHEETS EXTENDED.
- STEP 5. FOLD LEADING EDGE OF PAPER AS SHOWN.
- STEP 6. THREAD PAPER THRU EXIT SLOT.
- STEP 7. ALIGN PERFORATIONS WITH FORMS ALIGNMENT DECAL AND PUSH PAPER INTO PINS.
- STEP 8. MAINTAIN TENSION AT TOP OF PAPER WITH LEFT HAND.
- STEP 9. LIFT GATE SLIGHTLY.
- STEP 10. LIFT STAY BAR AND PUSH UPWARDS.
- STEP 11. RELEASE GATE AND LATCH.



FRONT VIEW

Figure 3-3. Paper Loading

SECTION IV THEORY OF OPERATION

4-1. GENERAL

4-2. This section contains functional and block diagram descriptions of the printer major assemblies. The ASCII character code and character matrixes are explained, followed by an overall description of the printer. A functional description of the mechanical printer assembly and operation of the print control PCB module assembly is given. Three typical interfaces (TTL, ROLM, and RS232) are covered as is typical front panel controls and indicators. This is followed by block diagram descriptions of three typical printer power supplies. Schematic diagrams of the printer are contained in Section VII of this manual.

4-3. BITE

4-4. Programmed instructions for a BITE check of the printer are contained in a programmed read only memory (PROM). These programmed tests exercise the same mechanical items and electronic circuits used in normal printer operation. The BITE function is initiated by actuation of the front panel mounted test switch.

4-5. CHARACTER CODING

4-6. The printer receives serial or parallel octal-bit coded ASCII characters which are formatted by the printer interface. The ASCII coded characters are decoded and converted into rows of character dots, using character dot matrixes stored in a ROM.

4-7. **ASCII INPUT CODE FORMAT.** The ASCII code format for 96 characters is shown in figure 4-1. Each set of seven bits (b7 through b1) is an octal coded number. Bit 7 is the most significant bit (MSB) and bit b1 is the least significant bit (LSB). For example, the set of seven bits 1101101 is octal number 155. Octal-bit numbers in figure 4-1 are cross referenced to ASCII characters which they represent.

4-8. **CHARACTER DOT MATRIXES.** Each ASCII character is printed out within a 9x7 dot matrix. (See figure 4-2.) With this matrix, a printed matrix is formed by up to seven dots out of 13 vertically and up to five dots out of nine in a row. The printing technique is explained in paragraph 4-13.

4-9. OVERALL OPERATION

4-10. The printer receives serial or parallel ASCII characters from a host computer, converts them into character dot patterns, and prints character dot lines to form the characters on paper. A block diagram of overall printer operation with major assemblies is shown in figure 4-3. The

interface board notifies the host computer when it is ready to receive octal-bit encoded ASCII characters. It converts the ASCII characters to printer compatible parallel data and provides formatting and storage. When the printer control board is not busy with a mechanical printer operation, it processes one line of 80 ASCII characters buffered from the interface board. The print control board microprocessor decodes the characters into character dot rows, using character dot matrixes, and also controls the mechanical printer operation, including the printing and advancement of paper forms. It keeps track of character column and row dot positions, composes each line of character row dots, and controls the printing.

4-11. At the mechanical printer assembly, 14 horizontal bars (hammers) are fired simultaneously against pressure-sensitive paper, fed across a double-pitched helix cylinder, to produce a line of 14 character row dots. During printing, the microcomputer controls carriage return, start of a new line, line feed, slewing of paper, and so forth. Operational sensors at the mechanical printer inform the printer control board of its mechanical readiness and paper forms status. Front panel controls are used to switch power on, to BITE check the printer, and to perform form feed, five line feed, and slew operations at the mechanical printer. The printer control board executes these commands by issuing mechanical printer control signals. Front panel indicators display the printer status conditions of power on and printer readiness. It also displays a paper low sensed condition. From the front panel, prime power is switched on to turn on the power supply and blower motors. The power supply furnishes unregulated voltages of (a) +24v to the mechanical printer, (b) +5, +13 and +15v and 25vac to the interface board, and (c) +10, +15, and +24v and -12v to the print control board.

4-12. **MECHANICAL PRINTER ASSEMBLY.** Figure 4-4 shows the mechanical and electromechanical functions of the printer. The following paragraphs describe the printing technique employed and the functions of the mechanical printer assembly elements during the printing process.

4-13. **Printing Technique.** Paper is fed between a row of 14 hammers and the rotating helix spiral. Each hammer has a horizontal printing bar which faces the longitudinal axis of the rotating cylinder. Wrapped around the rotating cylinder is a raised helix (spiral) which intersects one point on each hammer printing bar. The points are located at relatively the same position on each of the hammer printing bars and as the cylinder rotates, the points of intersection move from left to right along the printing bar, and then start again at the left on all 14 hammer printing bars.

BITS	b7 b6 b5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	COLUMN ROW	0	1	2	3	4	5	6	7
0 0 0 0	0	NUL	DLE	SP	0	@	P		p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	\$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	' (APOS)	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	1
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL

64 SYMBOL PRINTING SUBSET

96 SYMBOL PRINTING SUBSET

FULL 128 SYMBOL SET

Figure 4-1. ASCII Input Code Format

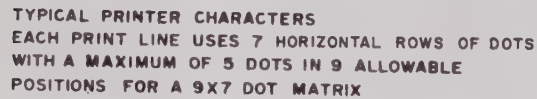
4-14. Each hammer has a voice coil, and when energized, the associated hammer is activated (fired). Logic low -HM1 through -HM14 signals from the printer control board are used to actuate the 14 hammers. The printing bar on the hammer projects forward, pinching the paper against the helix which cause a dot to be printed on the paper. During printing, the cylinder is driven by a motor-pulley belt combination, the direction of which provides a left to right scan of the helix. When hammers are fired, during the rotation of the helix assembly cylinder, a horizontal row of dots is printed along the width of each hammer. (See figure 4-2.)

4-15. The hammers are skewed to compensate for the fact that the paper moves during the printing operation. When the last dot at the right end of the hammer is printed, the helix is positioned to print immediately under the first (left-most) dot printed by the same hammer. The firing of each hammer is controlled by the printer microcomputer, so that

printed dots make up printed form characters. Alphanumeric characters are formed from a 9x7 matrix of dots. (See figure 4-2.) Typical examples of the way in which alphabetical characters are formed from this matrix are also shown in figure 4-2.

4-16. Each hammer prints six characters along a line producing 42 dots (six 5-dot characters and six 2-dot spaces). Therefore, 14 hammers can produce a maximum of 84 characters along a line, however, only 80 are used. One-half revolution of the helix assembly is required to print each row of dots, since a double pitch spiral is used.

4-17. Line Index Timing and Sensing Function. Timing elements are used to time sense the end of one line of dot-row printing (line index). One line of dot rows is printed each one-half revolution of the helix cylinder. A timing wheel with 82 teeth and two blank index spaces is mounted on the end of the helix cylinder. A magnetic pickup transducer,



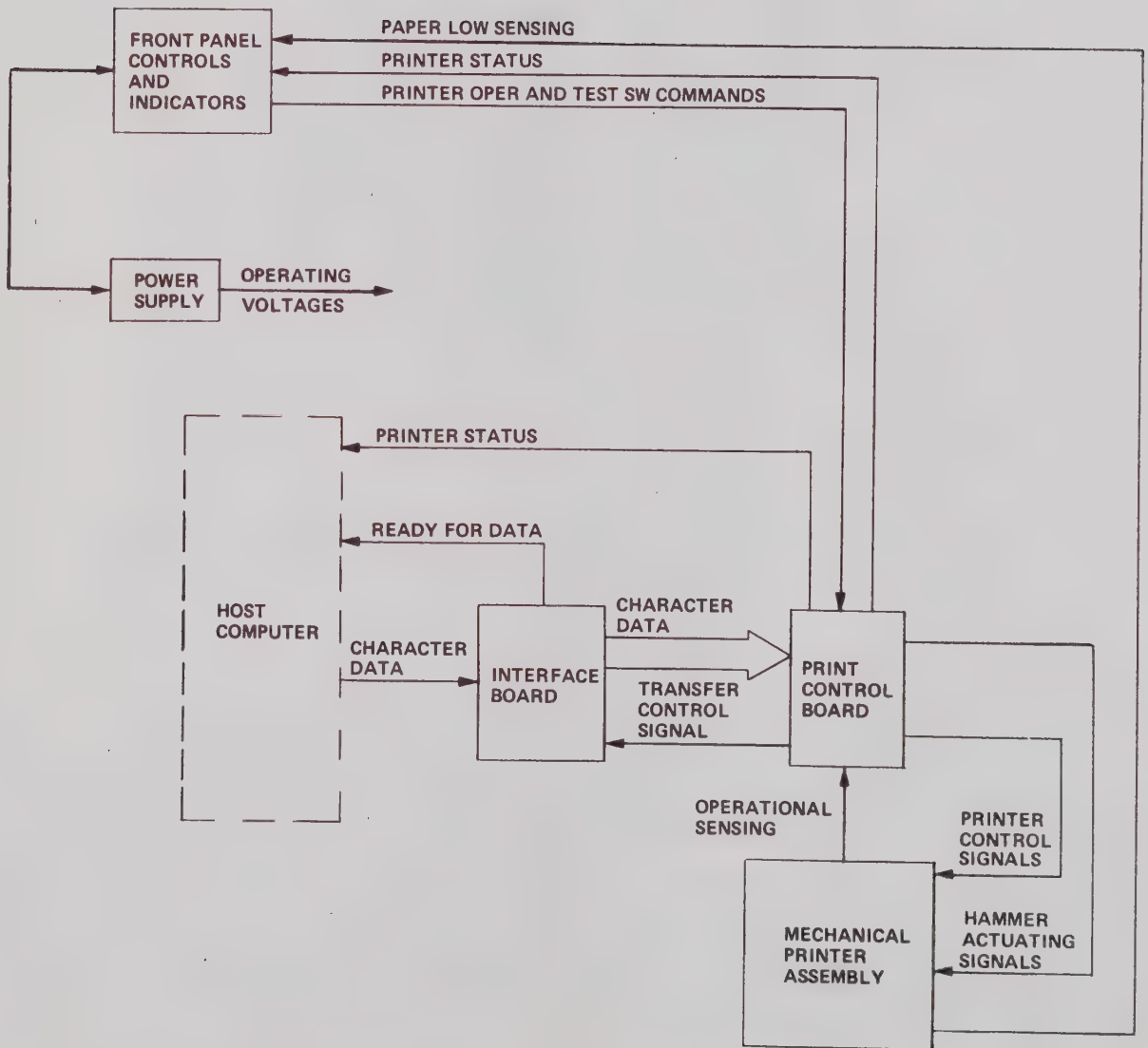


Figure 4-3. Printer Block Diagram

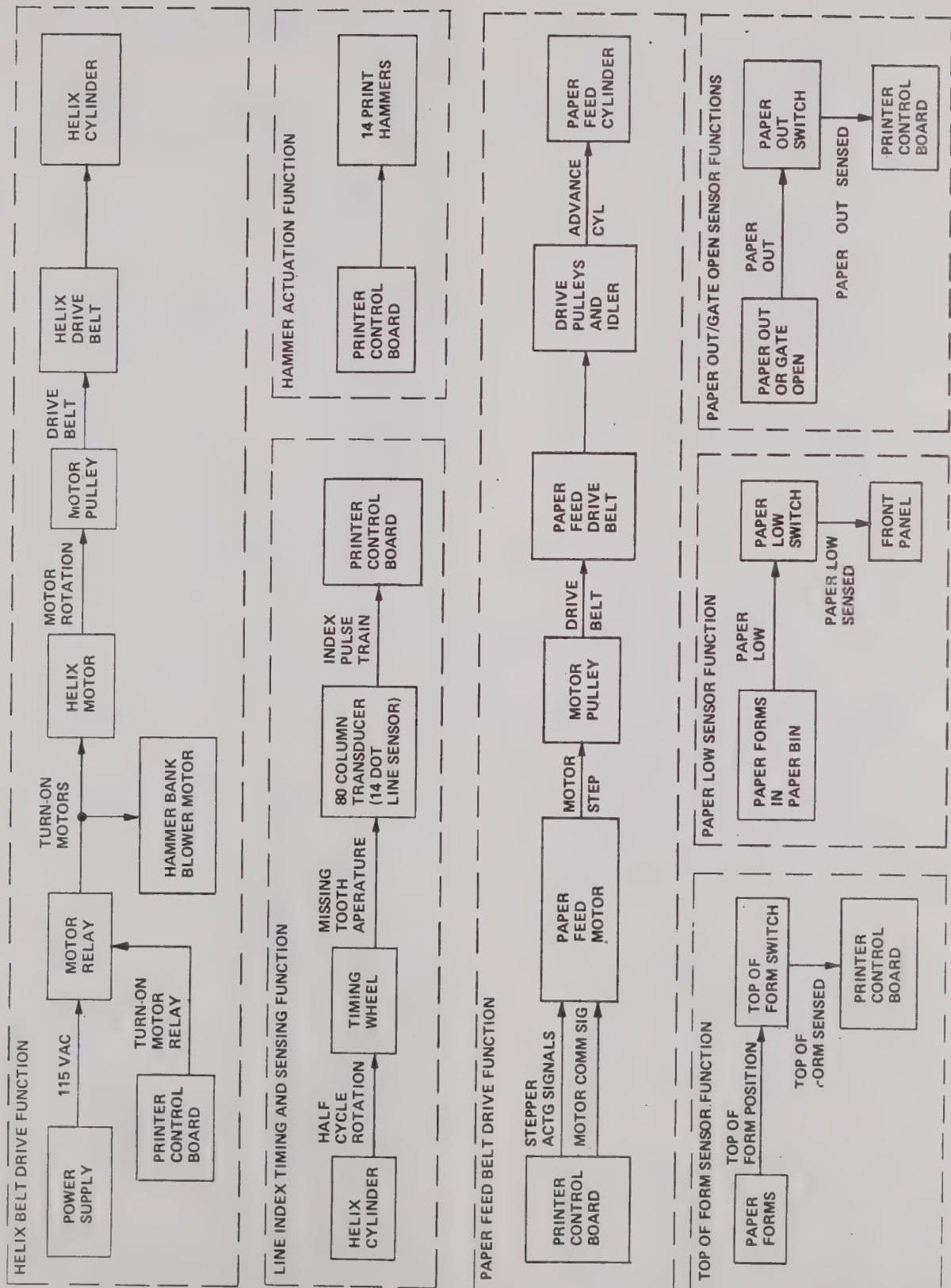


Figure 4-4. Mechanical Printer Assembly, Functional Block Diagram

positioned next to the timing disk, produces a current pulse each time one of the teeth passes the sensing head. These pulses correspond to the dots printed by each hammer blade. Each time a line index is sensed, the printer control board receives an indexed pulse train of 42 pulses. If the printer is equipped with the optional 132 column format, an additional timing wheel and transducer is used, which has 138 teeth and two blank index positions.

4-18. Helix Drive Belt Function. With the front panel POWER switch set to ON, primary power is applied to a motor relay. The printer control board then issues a +24 volt signal to energize the relay. The closed relay contacts then apply 115 volts ac to actuate the helix motor and blower motor. The helix motor rotation is transmitted through attached pulley and helix drive belt, causing the helix cylinder to rotate.

4-19. Paper Feed Belt Drive. As lines of characters are printed, the paper feed cylinders are rotated to advance a (multiple) paper form across the helix cylinder. This is accomplished by stepping the paper feed motor armature 90 degrees each time, and transmitting this 90-degree motor rotation to the paper feed cylinder. The motor is stepped 90 degrees by the pulsed stepper print and commutator signals which change the phasing between the motor windings. Each 90-degree rotation of the motor is transmitted to the attached motor pulley and paper feed drive belt. The belt movement, in conjunction with the drive pulleys and an idler, rotates the paper feed cylinder.

4-20. Top of Form Sensor. After multiple form paper is loaded into the mechanical printer, the serrated top edge of a (multiple) paper form is aligned with a white line on the TOP OF FORM plate. During the mechanical printer operation, a cycle of several advancements of the paper forms again lines up the top of a paper form with this white line. The top of form magnareed relay switch closes to sense this form position. A top of form logic low signal is then sent to the printer control board.

4-21. Paper Out/Gate Open Sensor. Normally, the gate is down and paper forms are sprocket-fed through the mechanical printer. The feeler arm of the paper out microswitch is pressed against the paper forms, keeping the switch contacts open. These switch contacts close when the gate is swung up or when no paper forms are fed through the mechanical printer. The closed switch contacts send a paper out logic low signal to the printer control board.

4-22. Paper Low Sensor. When there are sufficient multiple paper forms in the paper bin, the paper low switch contacts are kept open by a paper feeler arm which is held up by the stack of paper forms. When the paper form stack runs low, the paper feeler arm is lowered sufficiently to close the switch contacts, causing the printer control board to receive a logic low paper low signal, lighting the PPR indicator on the front panel. A screw

adjustment at the side of the switch assembly establishes the paper low detection level of the paper stack.

4-23. PRINTER INTERFACES. The printer is available with several different interface configurations. The following paragraphs cover the RS232 Serial, TTL, and NTDS interfaces.

4-24. RS232 Serial Interface (Figure 4-5). A host computer sends serial data of octal-bit encoded ASCII characters to line receiver U216. The line receiver changes the differential levels of the incoming serial character data to TTL level. The setting of the data normal 1 invert switch on the board determines whether controller U637 receives normal or inverted TTL levels of serial character data. The controller provides a file storage for the serial octal-bit encoded ASCII characters and keeps track of the accompanying octal-bit encoded control codes. Typical control codes are line feed (LF) and carriage return (CR). When U637 receives control codes for CR and LF, it notes that one line of 80 ASCII characters has been received. The controller keeps the ready line high to notify the host computer to continue to send serial character data. A high control ready signal from the controller to a ready gate keeps the ready line high. A low ready line notifies the host computer to stop sending serial character data. This occurs when the microprocessor on the printer control board is busy processing character data or when a paper out condition is sensed at the mechanical printer. When the microprocessor is busy, a high printer ready signal is sent to the controller. When the gate is up or no paper is threaded through the mechanical printer, a low paper out signal is sent to the controller from the paper out switch.

4-25. After formatting and storing the received ASCII characters and accompanying control codes, it buffer stores them in the 256x8 RAM (U615) for subsequent transfer to a RAM on the printer control board. Using control signals, the controller transfers this file of ASCII characters and accompanying control codes to address locations in U615. The printer ready signal remains high when the microprocessor on the printer control board is busy processing character data. When the printer ready signal goes low, the microprocessor is ready to receive new character data. The controller then has a file of ASCII characters and accompanying control code characters transferred from the RAM on the serial interface board to the RAM on the printer control board. A negative-going internal output data acknowledge strobe is used to strobe each character into the RAM. The printer ready signal goes high while a character is loaded into the RAM, and doesn't go low until the character is processed by the microprocessor.

4-26. TTL Interface (Figure 4-6). The host computer sends parallel data of octal-bit encoded ASCII characters to the TTL interface over seven parallel lines. These data are accompanied by -MR and -STROBE which enable the printer to synchronize the data from the interface with the

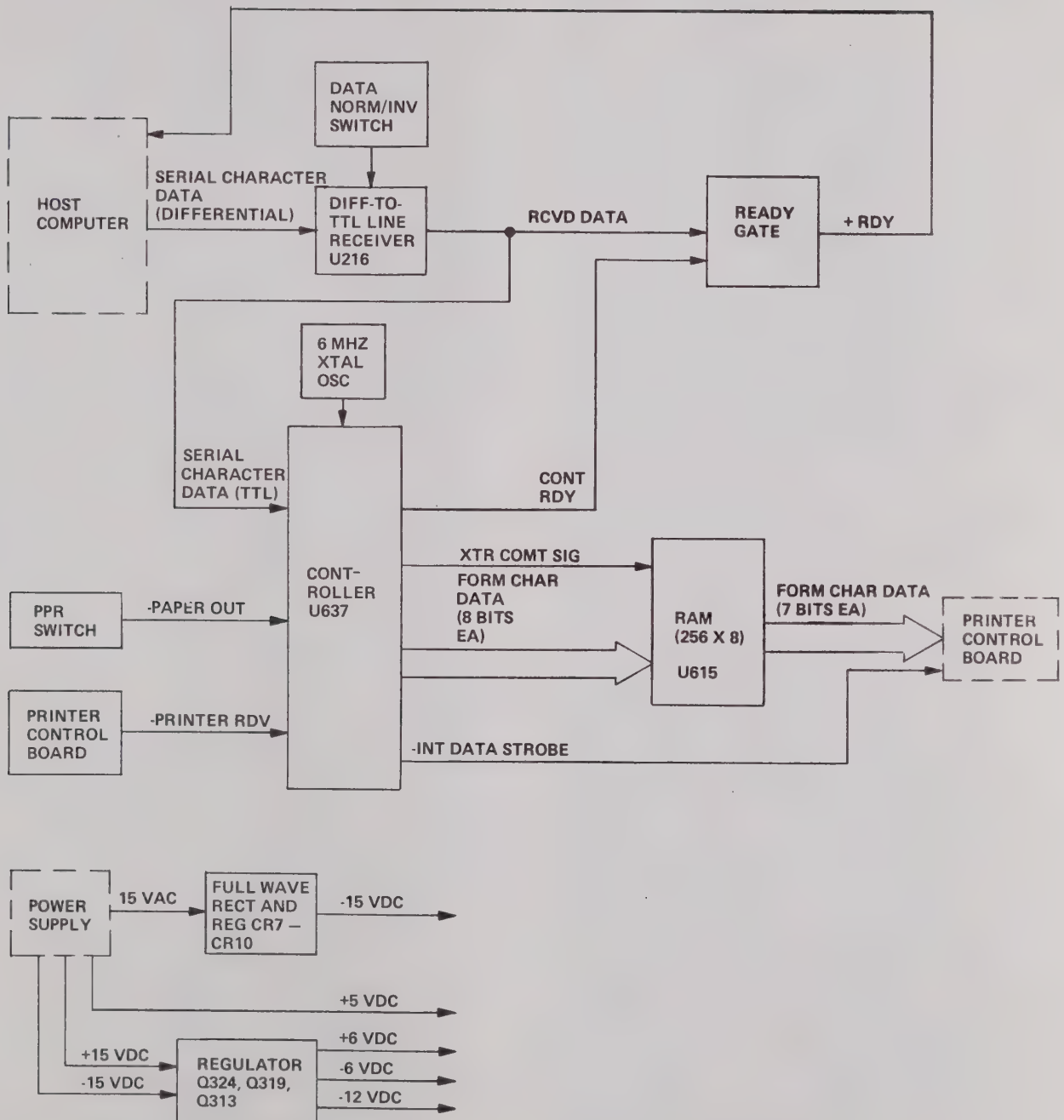


Figure 4-5. RS232 Serial Interface, Functional Block Diagram

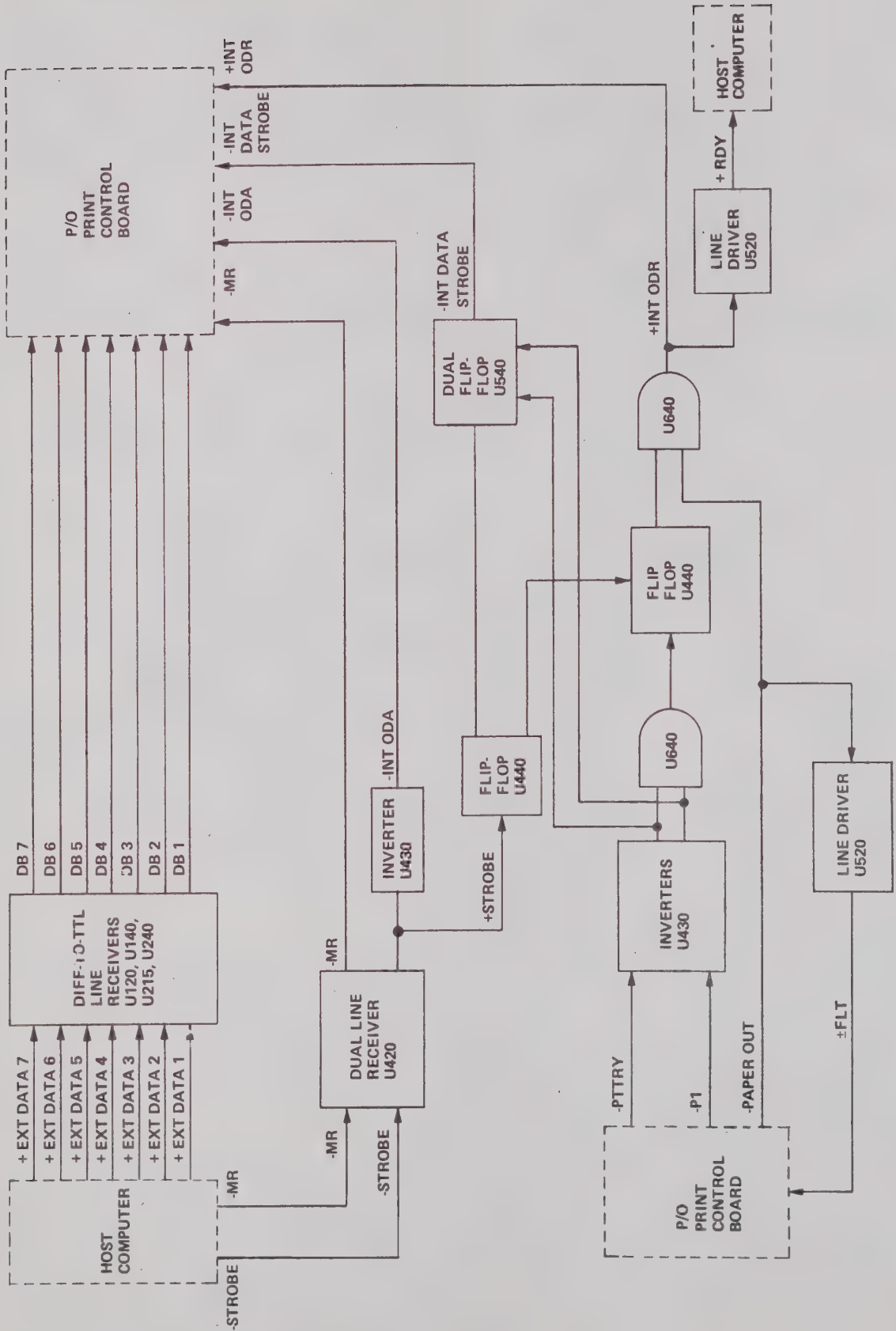


Figure 4-6. TTL Interface, Functional Block Diagram

external +RDY line.

4-27. Seven external data bits EXT DATA 1 through EXT DATA 7 are routed via differential-to-TTL line receivers to the print control board as DB1 through DB7. The -MR input from the host computer is also routed directly via a differential-to-TTL line receiver to the print control board. The -STROBE is received by differential-to-TTL line receiver U420, inverted by U430, and inputted to the print control board as the -INT ODA signal. The +STROBE output of U420 also sets flip-flop U440A. When set, U440A clears flip-flop U440B, thereby setting the +RDY line to a false or inactive state. The +RDY line remains inactive until the -PTTRY (printer ready) signal indicates that the printer is ready to accept the character. Thus, if U440A is set and -PTTRY is true, an -INT DATA STROBE is generated by U540 and sent to the print control board. The +RDY line is also set inactive when an active -PAPER OUT signal is received by the print control board.

4-28. NTDS Interface (figure 4-7). The NTDS interface is identical to the TTL interface (paragraph 4-26) except that line receivers are used to accommodate the parallel input data and control signals from the host computer.

4-29. PRINT CONTROL BOARD. (Figure 4-8.) The print control board contains a microcomputer to process octal-encoded ASCII characters into dot-pattern characters and to control operation of the mechanical printer. The microcomputer consists of a microprocessor, a PROM, and a RAM. The following paragraphs describe functions of the microcomputer elements and their common bus and control signals. These descriptions are followed by descriptions of other functions of the print control board.

4-30. Microcomputer Common Bus and Control Signals. A common bus is used to convey addresses or byte data between the microprocessor and either the RAM or PROM. The term byte means eight bits. The microprocessor controls operations of the RAM and the PROM with a group of central processor unit (CPU) control signals. These control signals determine when data is written into or read out of the RAM, PROM, and microprocessor, and when addresses are bused from the microprocessor to the RAM or PROM. The microprocessor uses 11-bit addresses to obtain a set of firmware program instructions from the PROM. The 11-bit addresses are configured on three bit lines of the PROM bus and eight bit lines of the address/data bus. The operation of the RAM is synchronized by the 6-MHz clock with the operation of the microprocessor.

4-31. Microprocessor. The microprocessor processes byte ASCII characters and byte control codes, stored in the RAM, with a set of firmware program instructions, retrieved from the PROM. Through the RAM and the PROM, the microprocessor controls operation of the mechanical printer, based on the control codes it receives. The microprocessor has repetitive cycles of operation. Microprocessor 6-MHz clock pulses are developed from

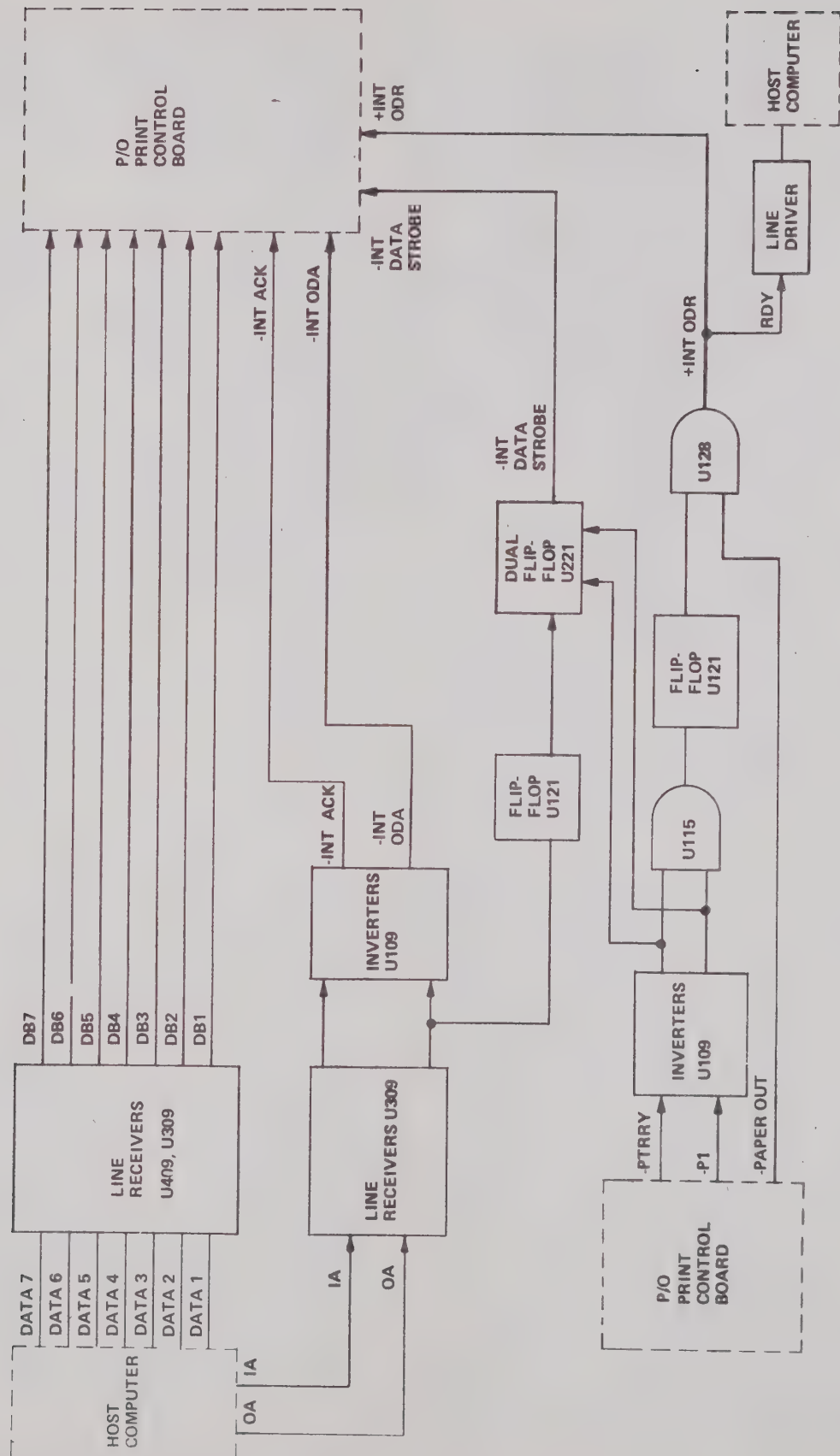
a 6-MHz crystal oscillator. Each cycle of operation is divided into three subcycles: fetch, read, and write. The operating time of a subcycle is approximately 500 nanoseconds and over 1.5 microseconds for a print cycle operation. When a print cycle is completed, a negative-going timing pulse from a line index register initiates microprocessor operation.

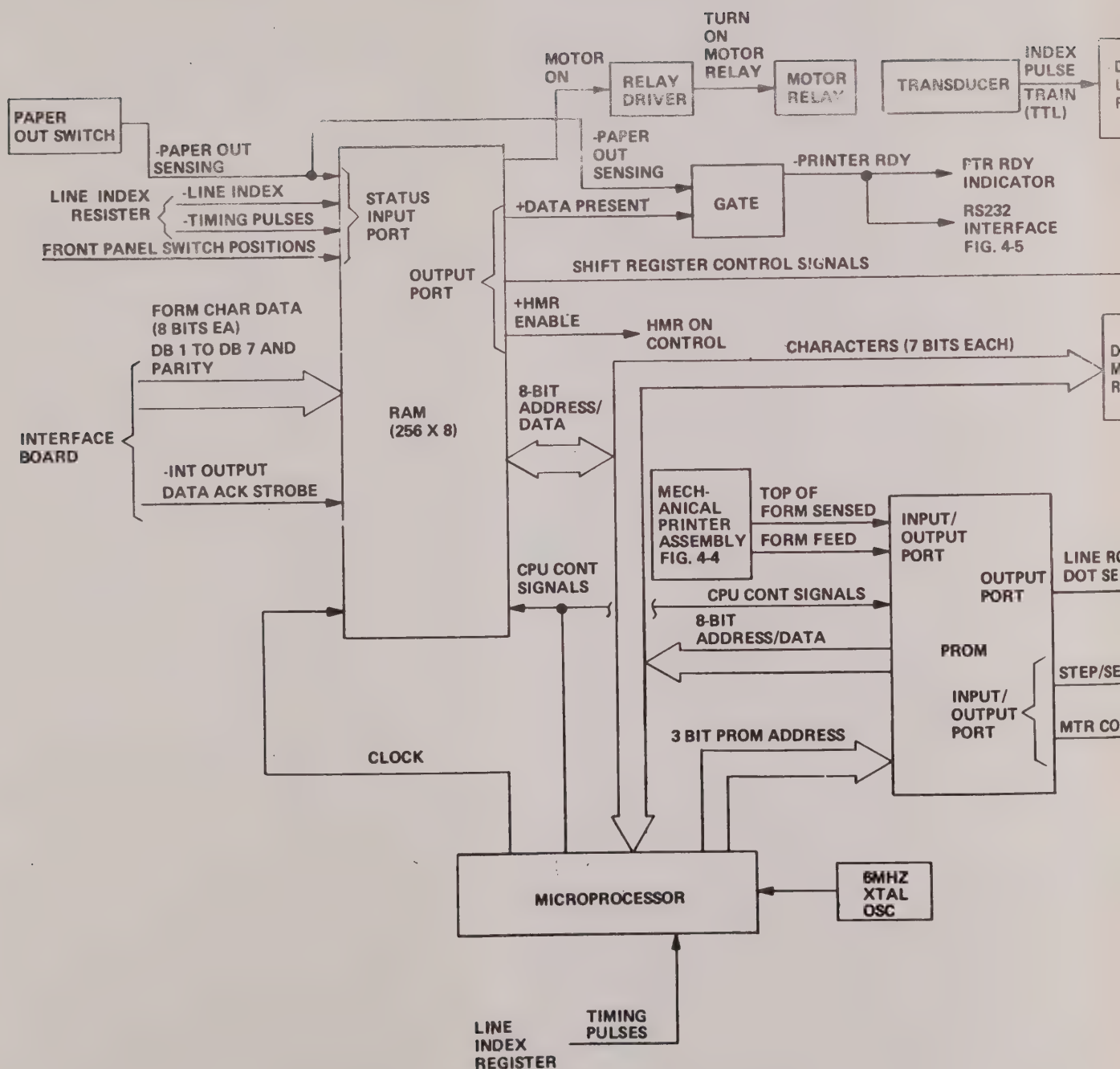
4-32. During the fetch subcycle, firmware program instructions are bused from the PROM to the microprocessor. During the read subcycle, either a byte ASCII character or a byte control code is read out from the RAM and bused to the microprocessor. Based on program instructions, the content of a byte ASCII character is rearranged and stored in microprocessor address locations and registers. During the write subcycle, seven bits of character data are bused to a dot matrix ROM. When the microprocessor receives a byte control code during an operational cycle, it decodes a printer operation instruction from the control code using the program instructions. It then addresses either the RAM or the PROM and retrieves the appropriate printer control signal. When the microprocessor processes one line of 80 ASCII characters from the RAM, it allows another line of 80 ASCII characters, with control codes, to be buffered into the RAM.

4-33. RAM. The RAM has two input ports, (data and status) and one output port, and contains 256-byte address locations. The following paragraphs cover the type of data received by the input ports, and subsequent processing and issuance of printer control signals from the output port.

4-34. Data Input Port. The controller on the RS232 serial interface board (figure 4-5) receives a low printer ready signal when the microprocessor is not busy and an after-print cycle has been completed. The printer ready signal goes low after the microprocessor has processed a line of 80 ASCII characters, previously stored in the RAM, and when there is no mechanical printer operation to implement. Then, a line of 80 ASCII byte characters is buffered one at a time on eight lines to one RAM input port. The eight lines are designated DB1 through DB7 plus a parity line. The ASCII byte character is loaded into the RAM during microprocessor operational cycle. Eighty ASCII characters are loaded into the RAM during 80 operational cycles. At each cycle, a negative-going internal output data acknowledge strobe from the controller is used to load an ASCII character. The printer ready signal remains high while a character is loaded into the RAM. It also remains high while a mechanical printer operation is being executed. While the printer ready signal remains high, no byte ASCII characters are buffered to this data input port. In the same manner, byte control codes, which accompany the ASCII byte characters, are loaded into the RAM through the data input port. The microprocessor continues to process each ASCII byte character per each operational cycle until all 80 ASCII byte characters are stored in the RAM.

4-35. Status Input Port. The microprocessor is informed of printer operational status by signals





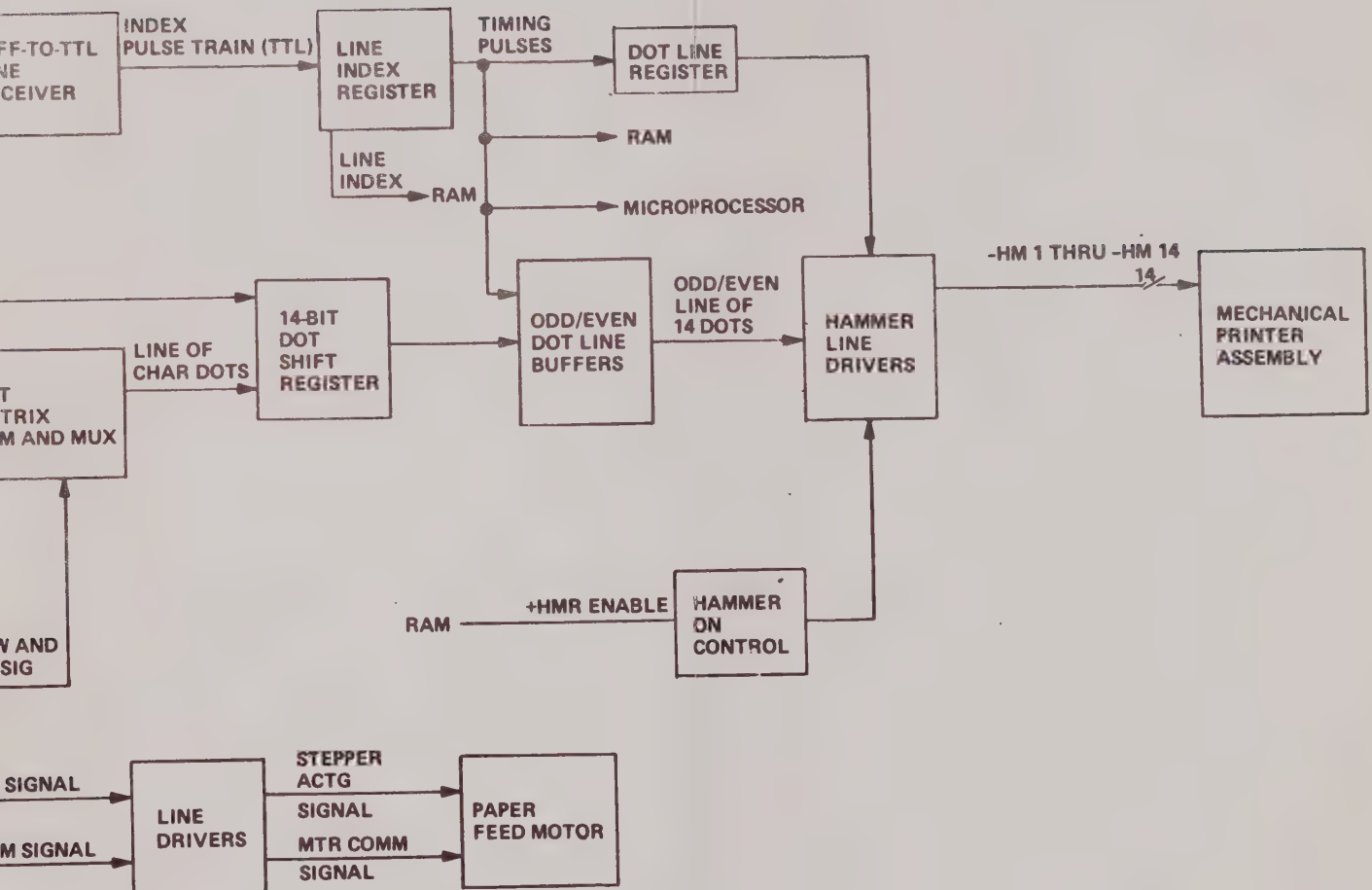


Figure 4-8. Print Control Board,
Functional Block Diagram

loaded into the other RAM input port. Logic levels of these signals are loaded as data bits into the RAM, and stored at designated address locations. The microprocessor uses CPU control signals to load these data bits into the RAM through the operational status input port. The operational status data bits stored in the RAM are processed as control codes by the microprocessor. The following paragraphs describe the operational status data.

1. Paper Out Sensing. A low paper out sensing signal is sent to the RAM by the closed contacts of the paper out microswitch. This means either that the gate is swung up or that no paper is threaded through the mechanical printer. This low signal causes the gating out of an inactive high printer ready signal. This high signal notifies the controller (serial interface board) not to buffer character data. It also turns off the RDY indicator on the front panel.

2. Line Index. The line index register sends a low line index signal to the RAM on completion of a print cycle. The microprocessor records this information in a register for the next print cycle.

3. Timing Pulses. When the line index register sends a logic low to the RAM on completion of a print cycle, it notifies the microprocessor that an odd row of 14 dots will be printed during the next print cycle. Likewise, a logic high received by the RAM on completion of a print cycle indicates that an even dot row of 14 dots will be printed during the next print cycle.

4. Test Switch Signal. A low test switch signal is received by the RAM when the FF/TST switch on the front panel is toggled to TST position.

5. Slew Switch Signal. A low slew switch signal is received by the RAM when the 5L/SLW switch on the front panel is toggled to the SLW position.

6. Fine Line Feed Switch Signal. A low fine line feed switch signal is received by the RAM when the 5LF/SLW switch on the front panel is toggled to the 5LF position.

4-36. Output Port. The microprocessor retrieves signals from the RAM output port which are used to control certain printer operations, processing of character dots, and data buffering. The following paragraphs discuss the signals issued from the output port.

1. Motor On Signal. After power is applied, the microprocessor retrieves a low motor on signal from the RAM. A relay driver changes the low signal to a +24v current signal which turns on a motor relay. Through closed relay contacts, 115 vac is applied to turn on the helix motor and a blower motor.

2. Hammer Enable Signal. The microprocessor issues a high hammer enable signal at

its output port. This signal turns on the hammer on control, which enables the hammer line drivers.

3. Data Present Signal. When the microprocessor is processing ASCII characters stored in the RAM, a high data present signal is issued from the output port. This high signal causes the gating out of a high printer ready signal and prevents the buffering of character data from the serial interface board. When the microprocessor is ready for more ASCII characters, a low data present signal is issued, resulting in a low printer ready signal. This low signal notifies the controller (RS232 interface board) to buffer ASCII character data. During the conditions just described, the RDY indicator remains lighted on the front panel.

4. Shift Register Control Signals. The microprocessor retrieves shift register control signals issued from the RAM to control operation of a dot shift register. A low load shift register signal is used to load dot bits into the shift register. A clear shift register signal clears the shift register before a print cycle.

4-37. PROM. The PROM contains the firmware program instructions for the microprocessor. It has 2048 bytes of read only memory, one input-output port, and one output port. The microprocessor uses program instructions to decode byte control codes and byte ASCII characters. The microprocessor uses a file of 11 bit addresses to read out the byte program instructions from address locations in the PROM. These 11 bit addresses are sent to the PROM on the collective 11-bit address lines of the address/data and PROM address buses. The set of program instructions are read out and sent to the microprocessor on the address/data bus. The following paragraphs discuss the signals' input to and output from the PROM ports.

4-38. Top of Form Sensed Signal. When the top of form switch senses the top of a paper form, it sends a low top of form sensed signal to PROM. This information is stored as a byte control code. It is then sent to the microprocessor with program instructions.

4-39. Form Feed Signal. When the FF/TST switch on the front panel is set to FF, the PROM receives a low form feed signal. The information is stored as a byte control. It is then sent to the microprocessor with program instructions.

4-49. Motor Stepper and Commutator Signals. A combination of one of four motor stepper signals and one of two motor commutator signals is used to advance the paper forms through the mechanical printer. Paragraph 4-19 describes the method employed to advance the paper forms. When the mechanical printer is operating, these signals are outputted automatically and line-driven as +24V current signals to the paper feed motor.

4-41. Line Row Select Signals. Four line row select signals are outputted from the PROM and

applied to a dot matrix PROM. ASCII characters to be printed are stored as character dot matrixes in the PROM. The four select signals are used to select seven out of 13 dot row lines. When printed out, the seven dot row lines selected form one line of characters. The four select signals are decoded into a dot-row line select. Typically, the way the dot row lines are decoded is depicted as follows:

Select Signals				Dot-Row Line Selected
2^3	2^2	2^1	2^0	
0	0	0	1	1
0	0	1	1	3
0	1	0	1	5
0	1	1	1	7
1	0	0	1	9
1	0	1	1	11
1	1	0	1	13

4-42. Dot Select Signals. Three dot select signals are outputted from the PROM and are applied to an eight bit multiplexer. The three select signals are used to select the dot to be printed from the character dot row selected. A character dot row can be composed of up to five out of nine dots. If the second dot is selected by the three select signals, then the second dots of 14 character rows will be printed. The three select signals are decoded into a dot select. Typically, the way a dot is decoded from a character dot row is as follows:

Select Signals			Dot Selected
2^2	2^1	2^0	
0	1	0	Second dot

4-43. Print Synchronization. One line of 14 character dots is printed during each half revolution of the helix cylinder. The method of sensing the end of a print cycle (line index) at the mechanical printer is discussed in paragraph 4-17. When the 80 column transducer senses a line index, it sends a train of 41 differential pulses to a line receiver (print control board), which converts the differential signal levels to TTL. The line index register phase-loop compensates for any irregularities in the pulse train due to irregularities in the timing disk. The register integrates the train of pulses into a timing pulse which is coincident with the end of a print cycle. The register produces a negative-going timing pulse when odd dots will be printed during the next print cycle. A positive-going timing pulse is produced when even dots will be printed during the next cycle. A negative-going timing pulse initiates the microprocessor operation. The register also produces a line index signal, which the microprocessor uses as a zero-time reference for the next print cycle.

4-44. Print cycle. The microprocessor initiates a print cycle when it receives the first line index and after: (1) the RAM is full, (2) the helix motor is up to speed, and (3) when the mechanical printer

is not performing a skip fold. The RAM is filled by 80 ASCII characters unless it receives an ASCII control code CR, LF, or FF; which causes the microprocessor to fill the RAM with blanks. When the RAM is filled, the microprocessor turns the helix motor on, if not already on, by a control signal from the microprocessor RAM. The helix motor turns off when not being used after a short time delay: less than 0.5 second. The microprocessor checks the speed of the helix by waiting for two consecutive valid line indexes. The next line index thereafter causes the microprocessor to initiate a print cycle. Various registers in the microprocessor keep track of the helix position on the helix cylinder. Since the character dot matrix is a field of 9x7 dots, seven helix scans are necessary to produce the seven horizontal dot lines necessary to complete a line of 80 printed characters.

4-45. Print cycle timing. Once the print cycle is entered, the microprocessor begins to scan the contents of RAM for the characters to be printed. Each edge of the index timing pulse train initiates interrogations of the microprocessor memory to determine the hammer dots to be printed at given points of time. Immediately after start of print cycle, the dot printing may be as follows: (1) Hammer 1 will print a dot in column 1, (2) hammer 2 in column 7, (3) hammer 3 in column 13, (4) hammer 4 in column 19, (5) and so forth, until hammer 14 prints a dot in column 78. Each hammer is printing one dot of one character as a parallel operation.

4-46. Character Dot Processing. Character dot matrixes for all the ASCII characters are stored in the PROM. The microprocessor scans its registers to find the address locations of 14 ASCII characters that will be printed, simultaneously. The 14 characters are bused to the PROM. The PROM converts the octal-encoded ASCII codes of the received characters into seven dot rows each. Four line-row select signals from the PROM send line count inputs to the PROM. A line count input selects one of seven rows. The dot row is routed to an eight bit multiplexer. From the PROM three dot select signals with a dot count are applied to the multiplexer. Based on the dot count, the next dot to be printed is demultiplexed from the selected dot row. For example, each of the first dots from 14 dot rows (14 characters) may be the 14 dots selected for the next line of print. The dot selected is then routed to a 14-bit shift register. A low-load shift register from the RAM is used to load the dot (bit) into the shift registers. In the same manner, the remaining 13 dot bits are serially loaded into the 14-bit shift register.

4-47. Hammer Dot Actuation. During a print cycle, the 14 hammers are fired simultaneously to print the selected 14 character row dots on paper. Before a print cycle, the 14 character row dots to be printed are stored in the 14-bit shift register. A high hammer enable signal from the RAM sets the hammer on control, which enables the hammer line drivers. The line index register produces a timing pulse at the end of a print cycle. A dot line register is loaded with a logic 1 which represents an even dot line. A logic 0 represents an odd dot line. The

logic 0 output from the register causes 14 character row dots from the shift register to be parallel-loaded into odd dot line buffers. From the dot line register, an odd dot line enable signal directs the hammer line drivers to accept 14 character row dots from the odd dot line buffers. In the same manner, a logic 1 output causes 14 character row dots to be loaded into even dot line buffers and then to be accepted by the hammer line drivers. The hammer line drivers change the 14 dot signals into 14 grounded hammer signals (-HM1 to -HM14). The 14 grounded hammer signals cause the hammers to fire simultaneously and print 14 dots on paper.

4-48. **Paper Control.** During the print cycle, paper is moved by a stepper motor that is under microprocessor control. Current-amplified, sequenced step 1 through step 4 signals from the PROM advance the stepper motor. The stepper motor is turned off when not being used.

4-49. **Control Code Functions.** The microprocessor also receives from the RAM characters (eight bits each) that contain control codes. When decoded by the microprocessor, each control code causes a certain function to be performed. The control code functions for the printer are described in the following paragraphs.

4-50. **Line feed.** When this control code is decoded, the microprocessor disregards the number of remaining ASCII characters stored in the RAM and returns to where it left off on the next print cycle.

4-51. **Form feed.** The form feed code, when decoded, causes the mechanical printer to print the lines of 80 characters in the RAM and to advance to a top of form position. The top of form position is sensed by a reed switch, actuated by a magnet in a gear driven from the paper drive shaft. The drive shaft is geared for one revolution for one sheet of paper. The microprocessor causes paper to be moved until top of form is sensed by the magnareed switch. A low top of form switch signal is decoded into an address which is sent to the PROM. The resultant output from the PROM is the instruction that controls paper movement.

4-52. **Carriage return.** After the microprocessor decodes the carriage return control code, it causes the mechanical printer to print the ASCII characters stored in the RAM, and to reposition the paper to allow printing of the next line of dots from the ROM.

4-53. **CR-LF sequence.** After the microprocessor decodes the CR-LF sequence code, it causes the mechanical printer to print one complete line of ASCII characters, as stored in the RAM. The mechanical printer then advances to the first column of the next line.

4-54. **Space code.** After decoding the space code, the microprocessor causes the mechanical printer to advance one character position without printing a character.

4-55. **FRONT PANEL CONTROLS AND INDICATORS (FIGURE 4-9).** The following paragraphs describe switch control functions and indicator monitored functions.

4-56. **Power Switch.** Setting the front panel POWER switch to ON applies primary power to the power supply. A fuse between the power source and the printer power supply protects the power supply components against an equipment overload.

4-57. **Five Line Feed.** Toggling the 5LF/SLW switch to 5LF advances the paper forms five lines through the mechanical printer. A grounded five line feed signal is sent to the printer control board. This information is stored in the RAM as a control code. After the microprocessor decodes this control code, it has the PROM output: the appropriate combination of motor stepper and commutator signals. These signals cause the paper feed motor to rotate and thereby advance the paper forms five lines.

4-58. **Form Feed.** Toggling the front panel FF/TST switch to FF advances the paper forms until the top of a paper form is aligned with TOP OF FORM white line. A grounded form feed signal is sent to the printer control board. This information is stored in the PROM as a control code. After the microprocessor decodes the control code, it addresses the PROM to output the appropriate instruction for motor stepper and commutation control. This instruction causes the paper feed motor to rotate to the extent required to advance the paper one paper form.

4-59. **Slew.** Toggling the front panel 5LF/SLW switch to SLW slews the paper forms out of the mechanical printer. A grounded slew signal is sent to the printer control board. This information is stored as a control code. After the microprocessor decodes the control code, it again addresses the PROM to output the instruction for continuous motor stepper and commutator control. This instruction causes the paper feed motor to keep running until the paper forms are slewed out of the mechanical printer.

4-60. **BITE Check.** Toggling the front panel FF/TST switch to TST implements the BITE check of the printer operation. A grounded test signal is sent to the printer control board. This information is stored as a control code. After the microprocessor decodes the control code, it fills the RAM with the set of ASCII characters that compose the test pattern. The two-line test pattern of ASCII characters is character-dot composed and printed out in the same manner as on-line printing.

4-61. **Fault Isolation.** When the paper out switch senses a paper out or gate up condition, the FLT indicator lights on the front panel. The closed switch contacts send a grounded fault signal to light the FLT indicator.

4-62. Paper Low Indication. When the paper low switch senses a paper form stack low condition in the paper bin, the PPR indicator lights on the front panel. The closed microswitch contacts send a grounded paper low signal to light the PPR indicator on the front panel.

4-63. Printer Ready Indication. The RDY indicator lights when the printer is operationally ready for normal operation. A gated out low present ready signal, from the printer control board, lights the RDY indicator. To keep the RDY indicator lit, the following conditions must be present:

1. Power is applied to the printer.
2. The helix motor is running at normal speed.

3. The gate is in position.

4. Paper forms are threaded through the printer.

5. On printer control board, RAM is filled with 80 ASCII characters, control code CR, LF or FF, or a test pattern.

4-64. POWER SUPPLY OPERATION. The printer is equipped with a basic power supply to provide the necessary operating voltages. These power supplies accommodate the input voltages listed in table 1-1. The power supply provided with a specific printer is schematically shown in the interconnection diagram. (Refer to Section VII.)

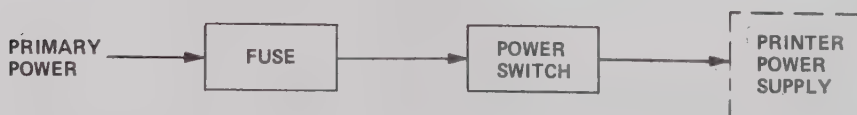
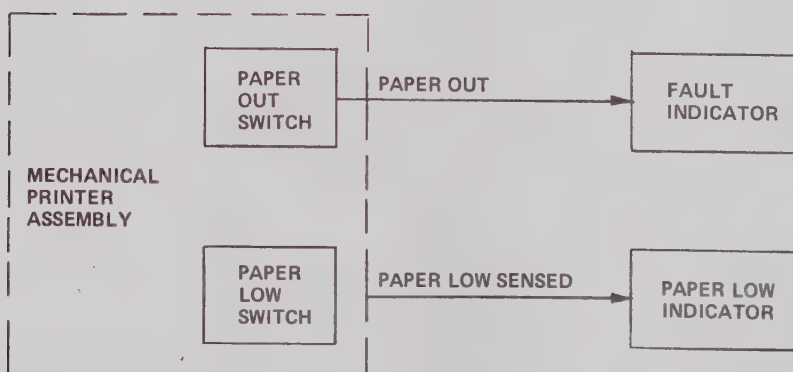
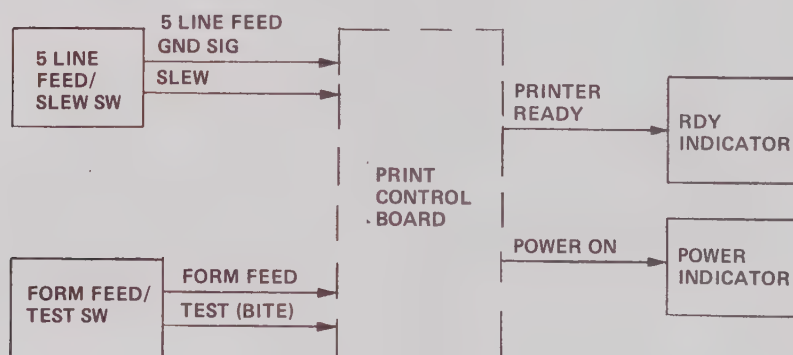


Figure 4-9. Typical Front Panel Block Diagram

SECTION V PREVENTIVE MAINTENANCE

5-1. GENERAL

5-2. This section provides the recommended preventive maintenance schedule for the printer. The recommended preventive maintenance consists of visual inspection, cleaning, mechanical checks, and lubrication. Table 5-1 lists the equipment and miscellaneous items required to perform the preventive maintenance. Table 5-2 outlines the recommended preventive maintenance schedule.

5-3. VISUAL AND OPERATIONAL INSPECTION

5-4. A careful visual and operational inspection for damage, abnormal wear, and proper functioning will help to insure proper operation of the printer. Perform the inspection as follows:

1. Remove the printer's electronics access panel and open the front cover. Remove paper.
2. Check wiring for properly mated connectors, loose connections, wear, or chafing.
3. Manually rotate the helix shaft and verify that no binding exists.
4. Visually check the helix drive belt for damage, cracks, or tears.
5. Visually check the paper feed drive belt for damage, cracks, or tears.

Note

Manually rotate the lower paper feed roller to permit a visual inspection of this belt.

6. Manually rotate the lower paper feed roller and verify that no binding exists in the paper drive system.

7. Set POWER switch to ON position. The green power, amber low paper, and red fault indicators should all light. The white ready indicator should not come on.

8. Set POWER switch to off position and load an excess of 40 sheets of paper into the printer.

9. Set POWER switch to ON. The low paper indicator shall not come on.

10. Momentarily place FF/TST switch in FF position. One sheet of paper shall slew.

11. Set the 80/132 COL switch to the 80 position. Momentarily place the FF/TST switch in TST position. The entire character complement shall be printed out in 80 column format.

12. Repeat step 11 with 80/132 COL switch set to the 132 position. The entire character complement shall be printed out in 132 column format.

Note

Printers not equipped with the 80/132 COL switch will print out in its configured column format.

13. Hold the 5LF/SLW in the 5LF position. The paper should advance 5 lines. Release the switch and note that the paper returns to its original position.

14. Hold the 5LF/SLW in the SLW position. The paper should slew at a constant rate so long as the switch is actuated.

15. Initiate one or two lines of self-test printout (FF/TEST switch set to TEST position) approximately 30 seconds following the completion of the last line printed. The helix should cease rotating (this serves as a check on the helix wake-up feature).

5-5. CLEANING

5-6. To clean the printer, proceed as follows:

1. Remove four screws securing the filter inspection plate to the right side of the printer enclosure and also at the rear intake duct.

Table 5-1. Equipment and Miscellaneous Items for Preventive Maintenance

DESCRIPTION	MODEL OR PART NUMBER	QUANTITY
Vacuum Cleaner	-	-
Lint-Free Cloth	-	-
Isopropyl Alcohol	-	As required
Grease	Lubriplate	1 tube

Table 5-2. Preventive Maintenance Schedule

ITEM	CLEAN	CHECK	ADJUST	LUBRICATE	PARA REF
Filter Element	80 hrs				5-5
Viewing Window	8 hrs				5-5
Paper Dust	40 hrs				5-5
Helix Assembly		40 hrs			5-3
Drive Belt		40 hrs	A/R		5-3
Forms Thickness Control				Annually	5-7

2. Remove the black foam filter elements by pulling outwards.

3. Clean the filter element by vacuuming.

4. Vacuum paper dust from the printer mechanism and inside of the front cover.

CAUTION

Care must be taken not to scratch metalized mylar film on the inside of the window.

5. Clean viewing window using a soft,

lint-free cloth moistened with isopropyl alcohol

5-7. LUBRICATION

5-8. The only elements of the printer requiring periodic lubrication are the Forms Thickness Control cams (lubricate grooves at both ends) and the adjustment screw threads. These elements are lubricated with Lubriplate grease as required.

SECTION VI MAINTENANCE

6-1. GENERAL

6-2. This section provides maintenance instructions for the printer. Detailed procedures are provided for checkout and troubleshooting of the printer, and for the replacement of assemblies, components, and parts of the printer. A list of recommended spare parts also is included.

6-3. TOOLS AND TEST EQUIPMENT

6-4. Table 6-1 lists the necessary tools and test equipment required to perform maintenance on the printer.

6-5. BASIC PERFORMANCE TEST

6-6. To verify proper printer operation, perform the following:

1. Secure power and signal connectors.
2. Set POWER switch to ON.
3. Load paper in the printer.
4. Set FF/TST switch to TST and verify that the appropriate test pattern (figure 6-1) is printed out.

5. Check that the printout quality is such that each character is easily recognizable without clipping or dot matrix degradation that would cause it to be illegible. The density of all characters shall be visually uniform.

6-7. FAULT ISOLATION

6-8. The troubleshooting procedures listed in

table 6-2 are designed to aid maintenance personnel in locating faulty assemblies or components in the printer. The troubleshooting procedures list the trouble symptoms that could be encountered during operation of the printer and the probable course for each symptom. The last column of the procedure gives the corrective action required to isolate and correct the malfunction.

6-9. REMOVAL AND REPLACEMENT PROCEDURES

6-10. The following paragraphs provide instructions for removing and replacing assemblies, components, and parts in the printer. Where alignment of a replaced part is required, it is integrated in the replacement procedures.

6-11. MECHANICAL PRINTER ASSEMBLY. The mechanical printer assembly is slide mounted in the printer enclosure (4, figure 6-2). To remove the mechanical printer assembly, perform the following:

1. Remove paper from the printer.
2. Set POWER switch to off.
3. Disconnect power and interface cables at J1 and J2 from printer.

Note

If printer is fixed mounted, disregard steps 4 and 5.

4. Remove the eight Camloc fasteners securing the printer to the equipment rack.

Table 6-1. Tools and Test Equipment

ITEM	MODEL OR PART NUMBER
Oscilloscope	Tektronix Model 533 with Type CA Preamp or Equivalent
Digital Multimeter	Dana Model 3800A or Equivalent
Spring Scale	Chatillon Gauge-R CATL 516-1000
Torque Socket Screw Driver 5 in/lb	Apco Mossberg
Hammer Alignment Tool	Miltope Part Number 461379
PCB Extender Cable Set	Miltope Part Number 461362-1

@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./
 0123456789:;<=>? !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
 !"#%&'()*+,-./0123456789:;<=>? !"#%&'()*+,-./
 0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>? !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN
 PQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?

A. 64 ASCII CHARACTER SUBSET WITHOUT GRAPHICS

6789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN
 PQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?

B. 64 ASCII CHARACTER SUBSET WITH GRAPHICS

123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?

C. 64 ASCII CHARACTER SUBSET (80 COLUMN) WITHOUT GRAPHICS

!"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?
 !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_ !"#%&'()*+,-./0123456789:;<=>?

D. 64 ASCII CHARACTER SUBSET (132 COLUMN) WITHOUT GRAPHICS

Figure 6-1. Typical Test Pattern Printouts

Table 6-2. Troubleshooting Procedure

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Printer does not power up (PWR indicator does not light).	1. Blown fuse. 2. POWER switch. 3. Line filter. 4. Connector J1. 5. Chassis Wiring.	1. Replace fuse. 2. Check continuity through switch. If open, replace switch (paragraph 6-12). 3. Check continuity through filters. If open, replace defective filter (paragraph 6-30). 4. Check and repair as necessary. 5. Check and repair as necessary.
Replaced fuse blows.	1. Power supply module. 2. Hammer module fan motor winding.	1. Check and repair defective component. 2. Check and replace motor (paragraph 6-16).

Table 6-2. Troubleshooting Procedure (Cont.)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Replaced fuse blows (cont.).	3. Helix motor windings. 4. Check connector and hammers wiring. 5. Defective hammer solenoid. 6. Print control board.	3. Check and replace motor (paragraph 6-15). 4. Check and repair as necessary. 5. Check and replace as necessary (paragraph 6-26). 6. Replace board (paragraph 6-28).
Printer not ready for normal operation. (RDY indicator does not light.)	1. RDY indicator. 2. Paper not threaded properly. 3. Gate is not in position. 4. Helix motor. 5. Helix drive belt. 6. Print control board.	1. Replace indicator. 2. Thread paper through machine. (Section III.) 3. Push gate home so that latches lock in place. 4. Check and replace if necessary (paragraph 6-15). 5. Check and replace if necessary (paragraph 6-18). 6. Replace (paragraph 6-28).
No message printout (test pattern printout normal)	1. Interface board. 2. Print control board.	1. Replace board (paragraph 6-28). 2. Replace board (paragraph 6-28).
No test pattern printout (message printout normal).	1. FF/TST switch. 2. Print control board. 3. Switch wiring.	1. Check continuity through TEST position of switch. If open, replace (paragraph 6-12). 2. Replace board (paragraph 6-28). 3. Check and repair as necessary.
Paper does not advance or advances erratically.	1. Paper drive belt loose or broken. 2. Print control board.	1. Adjust or replace as necessary (paragraph 6-19). 2. Replace board (paragraph 6-28).
Helix cylinder does not move or rotates erratically.	1. Helix drive belt loose or broken. 2. Helix drive motor. 3. Helix assembly. 4. Print control board.	1. Adjust and or replace (paragraph 6-18). 2. Replace motor (paragraph 6-15). 3. Adjust and or replace (paragraph 6-14). 4. Replace board (paragraph 6-28).

Table 6-2. Troubleshooting Procedure (Cont.)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Open hammer does not fire (14 character columns not printed).	1. Hammer assembly. 2. Print control board.	1. Replace hammer assembly (paragraph 6-26). 2. Replace board (paragraph 6-27).
False low paper indication (PPR indicator on with sufficient paper or off with less than minimum paper in paper supply bin).	1. Paper low switch.	1. Replace switch (paragraph 6-27).
False fault indication (FLT indicator on with sufficient paper forms in paper supply bin and gate detached in position).	1. Paper low paper switch. 2. Gate open switch.	1. Check and replace (paragraph 6-27). 2. Check and replace.

5. Slide the printer out from the equipment rack and remove the printer from the equipment rack slides.

6. Remove the screws securing paper exit shroud (2) to printer enclosure (4). Then lift the shroud clear of the printer.

7. Remove the screws securing electronics access panel (3) to enclosure (4).

8. Unplug the 14 sets of hammer leads from the forward end of the power PCB.

9. Remove six screws (located along both sides and rear edge of the PCB) retaining the printed circuit module and swing the modules up into a 90° position. Affix stay bar.

10. Remove two screws retaining connector J8. Unplug the connector.

11. Remove cap plugs (5) from each side of enclosure (4) to expose access hole to isolation mounting screw.

12. Remove isolator screw from each side of printer.

13. Open front door and remove isolator screw from each main frame leg.

14. Slide the mechanical printer assembly forward, out of enclosure (4).

15. Install replacement mechanical printer assembly and perform steps 1 through 14, in reverse order.

16. Perform paragraph 6-5.

6-12. FRONT PANEL CONTROLS AND INDICATORS. Perform the following:

1. Remove eight flathead screws securing control panel (7, figure 6-2) to enclosure (4).

2. Pull control panel forward to the extent permitted by the cable.

3. Disconnect wires to the defective control or indicator.

4. Remove mounting nut from defective control or indicator and remove control or indicator.

5. Install replacement component and repeat steps 1 through 4 in reverse order.

6. Perform paragraph 6-5.

6-13. TRANSDUCER. (4, FIGURE 6-3.) Perform the following:

Note

80/132 column printer uses two transducers.

1. Remove paper from printer.

2. Set POWER switch to off.

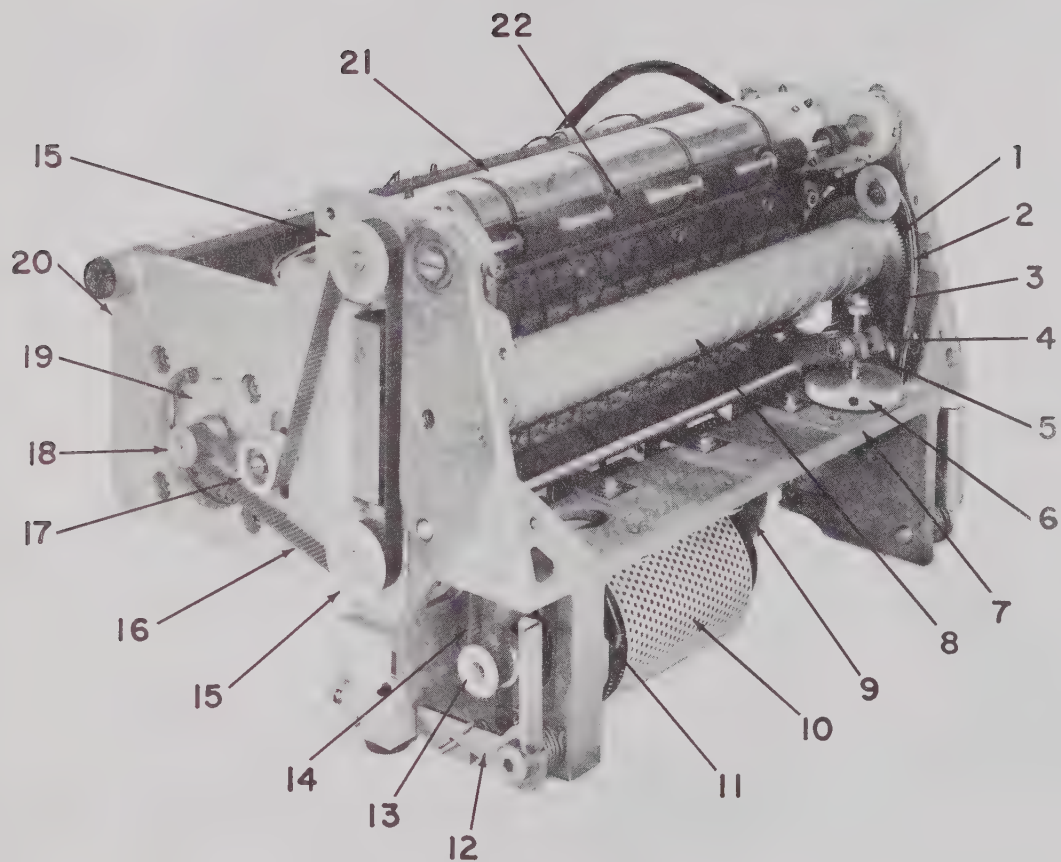
3. Remove screw securing transducer connector J6, J7 to gate casting (7).

4. Loosen set screw in transducer clamping block (3).

5. Remove flathead screw securing trans-



- Figure 6-2. Printer Assembly**



LEGEND

- | | |
|--------------------------------|--------------------------------|
| 1. Timing Wheel | 12. Gate Latch |
| 2. Transducer Clamping Block | 13. Helix Drive Motor Pulley |
| 3. Clamping Block Set Screw | 14. Helix Drive Belt |
| 4. Transducer | 15. Pulley |
| 5. Armature Adjusting Assembly | 16. Paper Feed Belt |
| 6. Forms Thickness Thumb Wheel | 17. Idler Assembly |
| 7. Gate Casting Assembly | 18. Paper Drive Motor Pulley |
| 8. Helix Assembly | 19. Paper Feed Motor Assembly |
| 9. Motor Mounts Bracket | 20. Main Frame Casting |
| 10. Motor Shield | 21. Paper Drive Wheel Assembly |
| 11. Helix Drive Motor | 22. Friction Paper Roller |

Figure 6-3. Mechanical Printer Assembly, Left Side View

ducer clamping block (2) to mounting.

6. Pull clamping block free and pull transducer out of block.

7. Snake transducer through hole in deck of gate casting (7) and remove.

8. Install replacement transducer and set gap between its pole tip and the teeth on the timing wheel (1) to .004+.001 inch.

CAUTION

Rotate helix and verify that pole tip clears teeth on timing wheel.

9. Repeat paragraph 6-5.

6-14. **HELIX ASSEMBLY** (Figure 6-4). Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Remove gate cover secured by four flathead screws.

3. Swing gate (1) open until the stay-bar drops in place.

4. Drive taper pins (2) out from cam using a small punch and hammer.

5. Loosen pinch screw (6) on forms thickness adjusting arm.

6. Slide camshaft (8) out of gate casting.

7. Loosen two nuts securing helix motor (3) to casting. Loosen nut securing other end of motor to mounting bracket.

8. Slip helix drive belt (9) off motor pulley.

9. Pivot helix and side plates forward out of gate casting so that the loading screw (4) is accessible.

10. Remove loading screw (4).

11. Push helix shaft (5) out from the center of the helix (two shims will drop free).

12. Remove helix assembly.

CAUTION

When installing replacement helix assembly, apply one drop of locking compound to threads of the loading screw (4) and tighten (finger tight). Excessive tightening may damage helix assembly.

13. Install replacement helix assembly by

performing steps 2 through 11 in reverse order.

14. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

15. Perform paragraph 6-5.

6-15. **HELIX MOTOR** (11, FIGURE 6-3). Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Remove flathead screw securing four-pin motor connector J4 to gate casting wall. Unplug connector.

3. Remove motor shield (10) by unscrewing three retaining screws.

4. Remove two screws securing motor mounting bracket (9) to gate casting.

5. Remove two nuts securing motor mounting bracket (9) to end of motor. Remove bracket.

6. Remove two nuts securing motor mounting studs to the gate casting (7).

7. Pull motor (11) free of gate casting (7).

8. Record axial position of motor pulley (13) relative to the motor face.

9. Loosen set screw in pulley hub. Remove pulley from motor and assemble onto the new motor shaft. Locate pulley to the axial dimension previously noted. Apply locking compound to set screw and tighten.

10. Reassemble motor to gate casting leaving the two securing nuts at each end "hand tight" so that motor can be moved to set required belt tension.

11. Pull motor downward until belt (14) becomes moderately taut. Tighten nuts at motor face.

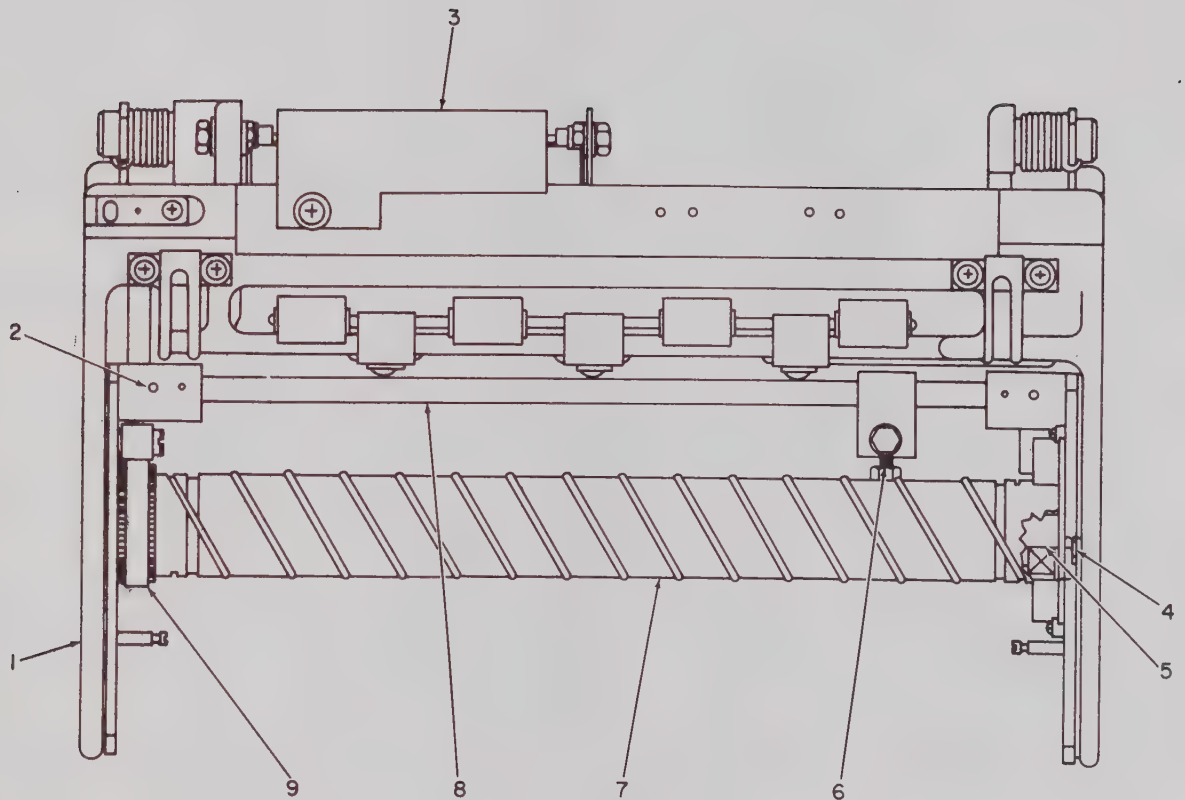
12. Rotate helix (8) manually to allow belt to track and centralize itself on both the helix and motor pulleys.

13. Measure belt tension by pulling outward on the belt at midspan with a spring scale. (See figure 6-5.) When tensioned properly, the belt will deflect 0.31 inches for an applied force of 2 pounds.

14. Retension belt if the criteria of step 13 is not met.

15. Rotate helix and verify that belt tracks properly and that no binding exists.

16. Reassemble nut to the rear of motor and mounting bracket and tighten.



NOTE:
SHOWN WITH GATE IN OPEN POSITION.

LEGEND

- | | |
|-------------------------------|------------------------------------|
| 1. Gate Assembly | 5. Helix Shaft |
| 2. Taper Pin | 6. Forms Thickness Adjusting Screw |
| 3. Helix Drive Motor Assembly | 7. Helix Assembly |
| 4. Helix Loading Screw | 8. Camshaft |
| 9. Helix Drive Belt | |

Figure 6-4. Helix Assembly Removal

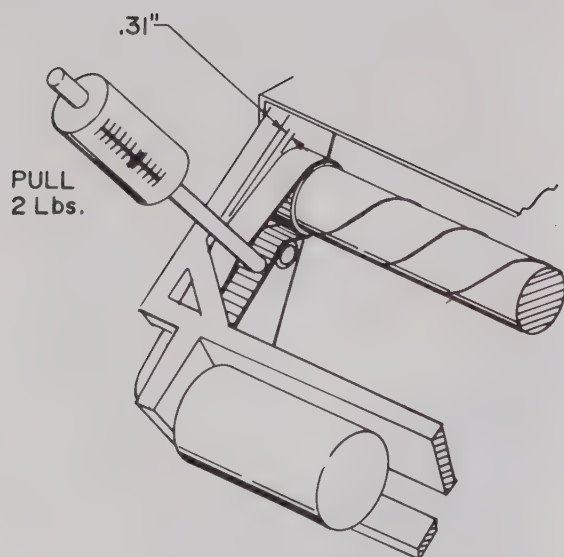


Figure 6-5. Outward Belt Tensioning

17. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

18. Perform paragraph 6-5.

6-16. BLOWER MOTOR (7, FIGURE 6-6). Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Tag and remove the four motor leads from TB-1, terminals 1, 2, and 3.

3. Remove two nuts and associated hardware securing end of motor to mounting bracket.

4. Pull air filter element (3) from blower inlet.

5. Loosen set screws securing blower impeller (4) to motor shaft. Slide impeller off shaft.

6. Remove two nuts and associated hardware securing motor face to blower housing. Pull motor free.

Note

Clean filter element prior to replacing.

7. Install replacement blower motor by performing steps 2 through 6 in reverse order.

8. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11,

in reverse order.

9. Perform paragraph 6-5.

6-17. PAPER FEED MOTOR (19, FIGURE 6-3). Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Tag and disconnect motor leads from TB-1 terminals 5 through 10.

3. Loosen tension idler assembly (17) by rotating slotted mounting stud 1/2 turn with a flat bladed screw driver.

4. Slip belt (16) off motor pulley (18).

5. Remove four screws securing motor mounting flange to main frame casting (20). Pull motor free.

6. Record axial position of pulley on motor shaft.

7. Loosen set screw in hub of pulley and slide off the motor shaft.

8. Assemble pulley to shaft of replacement motor to the axial dimension previously noted. Apply locking compound to set screw and tighten.

9. Reassemble motor to main frame casting and reconnect lead wires.

10. Slip belt over motor pulley and retention by sliding idler pulley stud along its mounting slot. Tighten stud.

11. Measure belt tension by pushing inward on the belt at midspan with a spring scale. (See figure 6-7.) When tensioned properly, the belt will deflect .18 inches for an applied force of .75 pounds.

12. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

13. Perform paragraph 6-5.

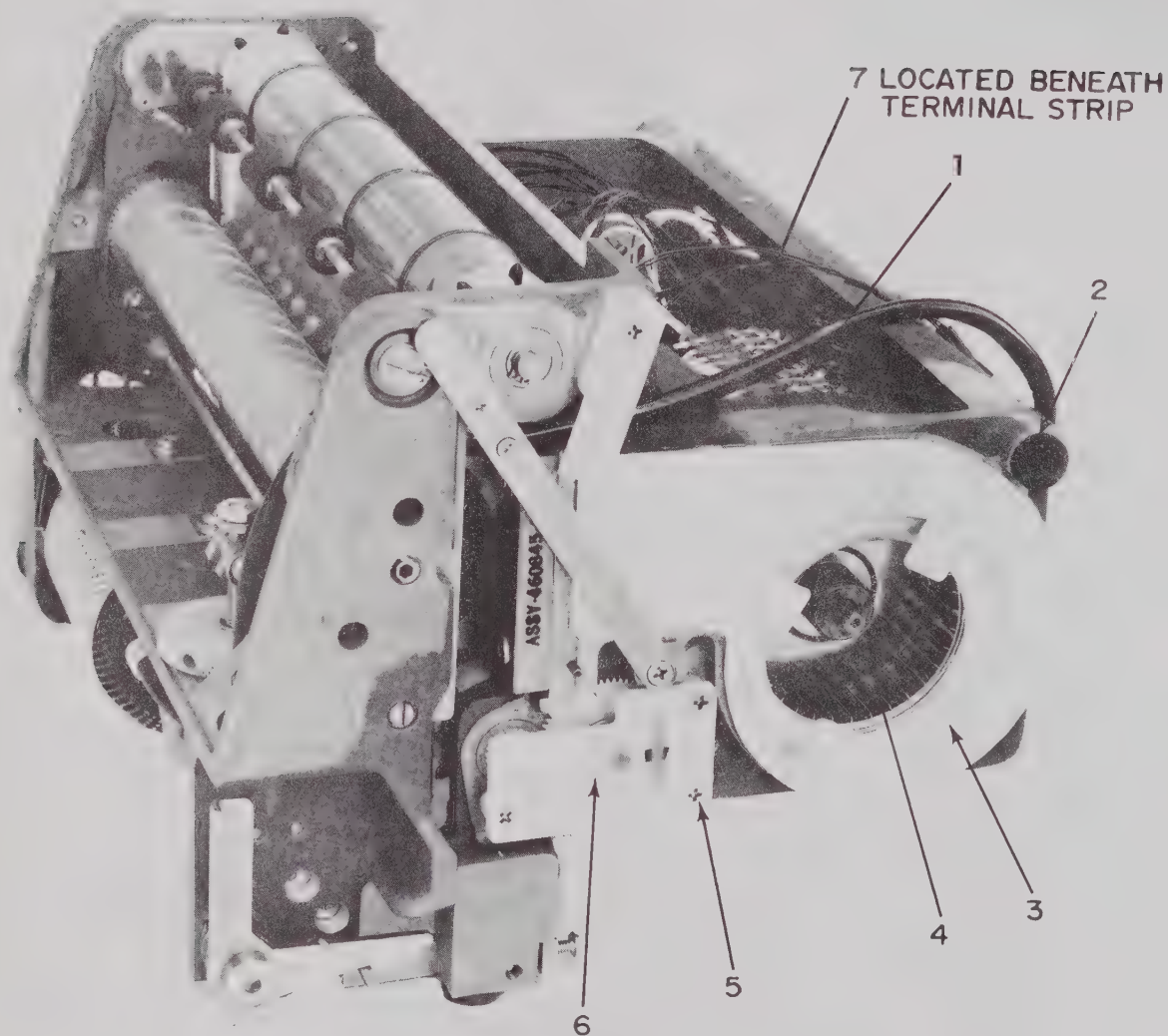
6-18. HELIX DRIVE BELT (14, FIGURE 6-3). Perform the following:

1. Remove helix assembly (paragraph 6-14, steps 1 through 12).

2. Loosen the two nuts at each end securing helix motor (11) to gate casting (7).

3. Slip replacement belt through cutout in casting and over drive motor pulley (13).

4. Replace helix assembly with replacement belt by performing steps 4 through 12 of paragraph 6-14 in reverse order.



LEGEND

- | | |
|-----------------------------|-------------------------|
| 1. Terminal Board | 4. Blower Impeller |
| 2. Blind Nut, 10-32 | 5. Flathead Screw |
| 3. Air Filter Element | 6. Top of Form Assembly |
| 7. Hammer Bank Blower Motor | |

Figure 6-6. Mechanical Printer Assembly, Right Side View

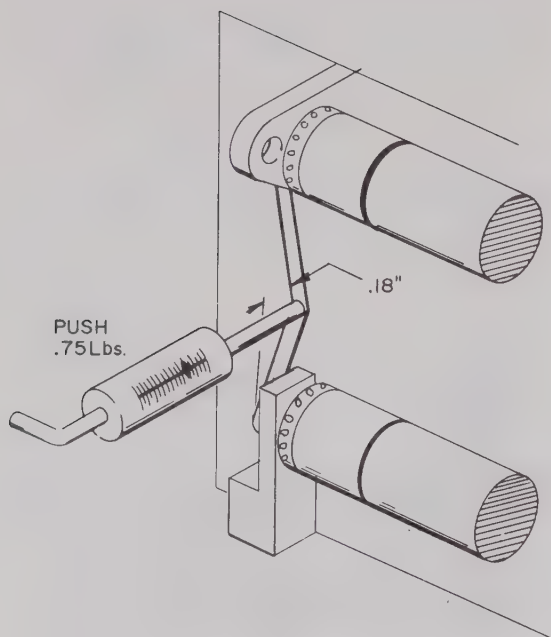


Figure 6-7. Inward Belt Tensioning

5. Perform steps 11 through 15 of paragraph 6-15.

6. Swing gate assembly down until it latches in position.

7. Replace gate cover using the four flat-head screws.

8. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

9. Perform paragraph 6-5.

6-19. PAPER FEED DRIVE BELT (16, FIGURE 6-3). Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Loosen tension idler assembly (17) by rotating slotted mounting stud 1/2 turn with a flat bladed screw driver.

3. Slip drive belt off idler assembly, motor pulley (18) and the two pin-wheel drive pulleys (15).

4. Slip replacement belt over motor pulley, idler assembly and the two pin-wheel drive pulleys.

5. Tension drive belt moderately by sliding idler pulley stud along its mounting slot and then tightening.

6. Measure belt tension by performing step 11 of paragraph 6-17.

7. Retension belt (step 5) if the criteria in step 6 is not met.

8. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

9. Perform paragraph 6-5.

6-20. TIMING GEAR (1, FIGURE 6-3). Perform the following:

1. Remove the helix assembly (paragraph 6-14, steps 1 through 12).

2. Scribe position of one of the missing tooth positions of the timing gear relative to the mounting flange.

3. Remove two flathead screws securing the timing gear to the flange on the helix assembly. Slide gear off the helix hub.

4. Position replacement gear on the helix hub so that the missing tooth position is aligned with the scribe mark and tighten the two flathead screws.

5. Replace the helix assembly by performing step 13 of paragraph 6-14.

6. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

7. Perform paragraph 6-5.

6-21. HELIX MOTOR AND/OR BLOWER MOTOR CAPACITORS. To replace helix motor capacitor (2) and/or blower motor capacitor (3) figure 6-8, perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Pull insulating boot and push-on terminals from tabs of top of the faulty capacitor.

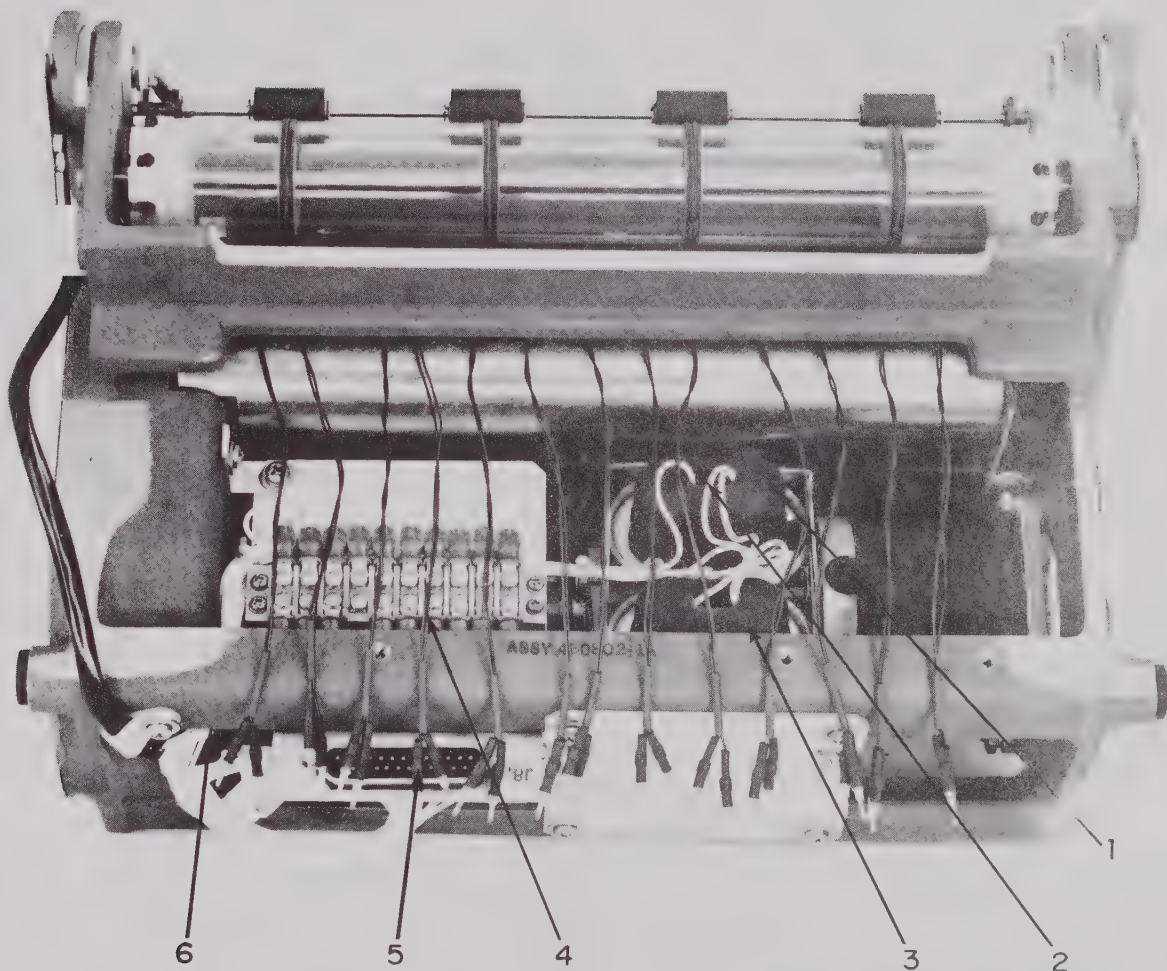
3. Loosen four screws retaining clamp bracket (1) to mounting bracket.

4. Pull faulty capacitor upwards and out of its mount.

5. Slip replacement capacitor into position taking care that the sponge rubber compression pad is in place.

6. Tighten the four clamp bracket screws.

7. Reconnect the push-on terminals and snap the rubber boot back into place.



LEGEND

- | | |
|----------------------------------|---------------------------|
| 1. Retaining Clamp Bracket | 4. Terminal Strip |
| 2. Capacitor (Helix Drive Motor) | 5. Connector |
| 3. Capacitor (Blower Motor) | 6. Hammer Assembly (lead) |

Figure 6-8. Mechanical Printer Assembly, Top View

8. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

9. Perform paragraph 6-5.

6-22. **MOTOR STARTING RELAY.** A solid-state helix drive motor starting relay, located above the paper feed stepper motor (19, figure 6-3), is used on machines requiring 115vac and 220vac, input power. To replace the motor starting relay, proceed as follows:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Tag and disconnect 4 leads from relay going to terminal strip (4, figure 6-8).

3. Remove 2 mounting screws (one on top and one on side) securing relay to main frame casting.

4. Install replacement relay by performing steps 2 and 3 in reverse order.

5. Replace mechanical printer assembly by performing steps 1 through 14 of paragraph 6-11 in reverse order.

6. Perform paragraph 6-5.

6-23. **TOP-OF-FORM (TOF) ASSEMBLY.** (6, FIGURE 6-6.) Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Push pins 4 and 17 from connector P8.

3. Mark position of TOF gear assembly relative to the TOF plastic housing.

4. Remove three flathead screws (5) securing the TOF assembly to the main frame casting.

5. Pull assembly directly outward and away from side of casting while simultaneously snaking its two lead wires out through hole in the casting.

6. Set TOF gear on the replacement TOF assembly to the same position as that marked for the original unit.

7. Snake the two lead wires through hole in the casting and while holding gear in place, slip TOF assembly in place.

CAUTION

Do not upset angular position of white plastic pinion.

8. Secure replacement TOF assembly using three flathead screws (5) removed in step 4.

9. Push the two lead wires into pins 4 and 17 of P8.

10. Replace mechanical printer assembly by performing steps 1 through 14 in paragraph 6-11 in reverse order.

11. Perform paragraph 6-5.

6-24. **PAPER OUT SWITCH ASSEMBLY.** (1, FIGURE 6-9.) Perform the following:

1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Remove the flathead screw securing connector J5 to the gate casting.

3. Remove the two screws securing the paper out switch bracket to the gate casting and remove the assembly.

4. Mount replacement assembly leaving screws snug but not tight.

5. Connect J5 and tighten its mounting screws.

6. Set switch position by moving its bracket forward or backwards while performing the following:

a. Rotate lower paper feed roller (4).

b. Check that the switch contacts close when the tip of its lever falls into the slot cut into the roller and opens when the lever tip is riding on the rollers circumference.

c. Adjust switch assembly accordingly and tighten screws when set.

7. Replace mechanical printer assembly by performing steps 1 through 14 in paragraph 6-11 in reverse order.

8. Perform paragraph 6-5.

6-25. **HAMMER BANK.** (3, FIGURE 6-9.) Perform the following:

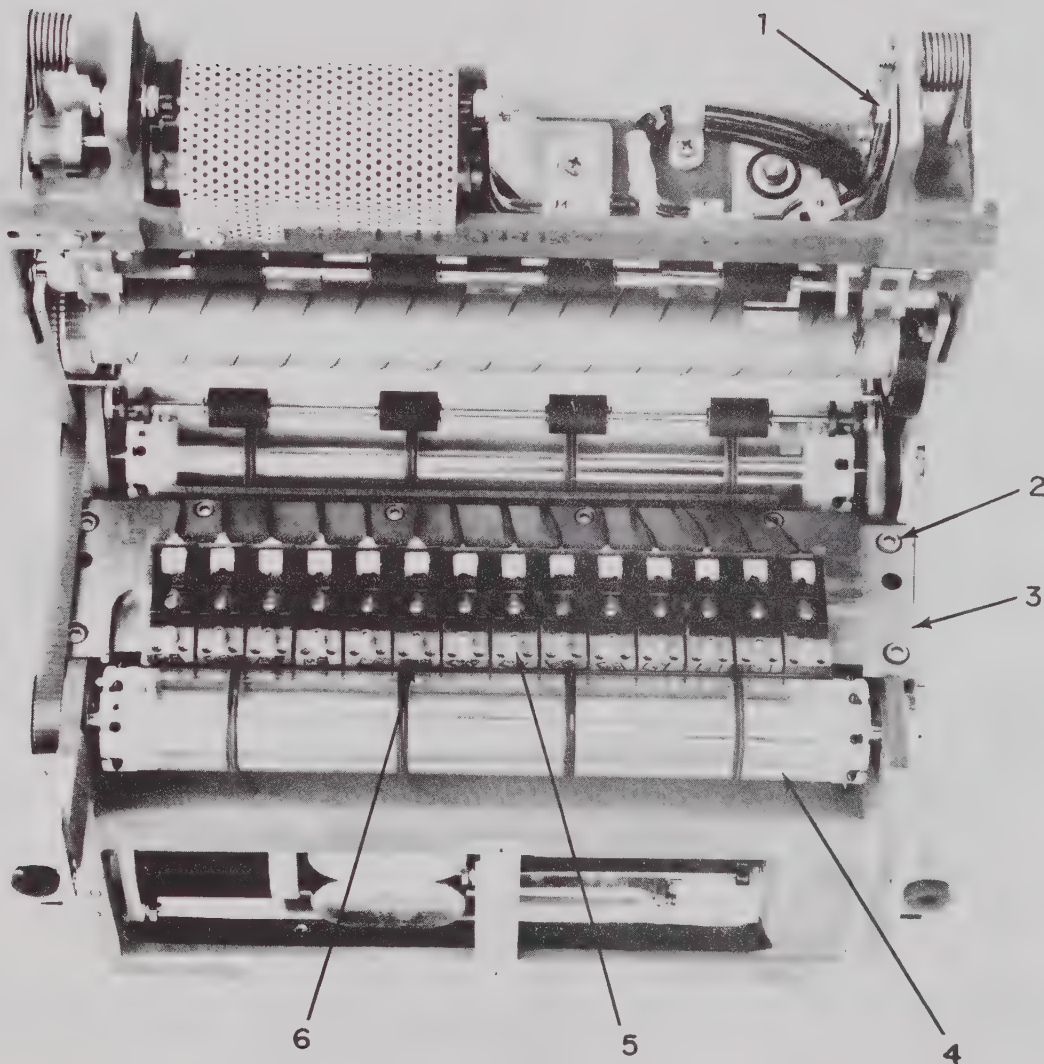
1. Remove mechanical printer assembly (paragraph 6-11, steps 1 through 14).

2. Tag and unplug the 14 pairs of hammer leads.

3. Remove four socket head screws (2) securing the hammer bank to the main frame casting.

4. Pull hammer bank forward and off the two dowel pins.

5. Install replacement hammer bank assembly by performing steps 2, 3, and 4 in reverse order.



LEGEND

- | | |
|------------------------------|----------------------------|
| 1. Paper Out Switch Assembly | 4. Lower Paper Feed Roller |
| 2. Socket Head Screw | 5. Socket Head Screw |
| 3. Hammer Bank Assembly | 6. Hammer Assembly |

Figure 6-9. Mechanical Printer Assembly, Front Bottom View

6. Replace mechanical printer assembly by performing steps 1 through 14 in paragraph 6-11 in reverse order.

7. Perform paragraph 6-5.

6-26. **HAMMER REPLACEMENT/ADJUSTMENT.** (6, FIGURE 6-9.) To replace a hammer, perform steps 1 through 8. To adjust a hammer to print properly, perform steps 9 through 13.

1. Set POWER switch to off.

2. Open the front cover and open the gate.

3. Remove the paper guide by removing four screws.

4. Remove hammer lead clamp bar.

5. Remove two socket screws (5) securing hammer (6) to hammer bank assembly (3) and remove hammer by pulling straight out.

Note

The new hammer to be installed in the next step has been factory set and will require only slight adjustment to achieve a proper printout. Under no circumstances change the position of the adjusting set screws at this time. These screws are adjusted, if required, during a later step.

6. Position new hammer by carefully sliding voice coil of hammer over pole piece.

CAUTION

Use extreme caution positioning hammer voice coil. The assembly is fragile and easily damaged by excessive force of mishandling.

7. Replace two socket screws (5) and hand tighten to leave hammer free to move during adjustment.

8. Place hammer alignment gauge (Miltope part number B461379), shown in figure 6-10, against other hammer blades and push new hammer upward to align with steps in tool. (See figure 6-11.) When alignment is complete, tighten socket screws to a torque of 56 inch ounce.

9. Load paper into printer and set POWER switch to ON.

10. Set and hold the momentary 5LF/SLW switch to SLW. Press the control panel while adjusting the FORMS THICKNESS control towards the THIN position. Adjust until a light smear is seen on the paper caused by the hammer blades.

11. Examine the smear pattern. Make corrections as required, in accordance with steps 12 through 15, with printer power off. Generate a fresh smear pattern after each adjustment to judge the effect of the adjustment.

Note

Clockwise rotation of the adjusting screws forces the hammer up against the mounting screws. Slightly loosen mounting screws before making adjustment and retighten to proper torque (step 8) when adjustment is complete.

Note

Adjust in very small increments of approximately one degree rotations of setscrews so as to approach the correct setting, without overshooting.

12. If printout across hammer blade width is uniform in density but light, rotate upper set-screw clockwise.

13. If printout cross hammer blade width is uniform in density but dark, rotate upper set-screw counterclockwise.

14. If printout across hammer blade width is non-uniform in density and light on the right side, rotate lower left setscrew counterclockwise.

15. If printout across hammer blade width is non-uniform in density and light on left side, rotate lower right setscrew counterclockwise.

16. When smear pattern is consistent for all hammers, turn printer off and recheck new hammer with alignment tool. Blade must be against step in tool and not interfering with adjacent hammer blades.

17. Replace the paper guide using the four screws removed in step 3.

6-27. **LOW PAPER SENSOR ASSEMBLY.** Perform the following:

1. Set POWER switch to off.

2. Open front door.

3. Remove twelve screws securing the

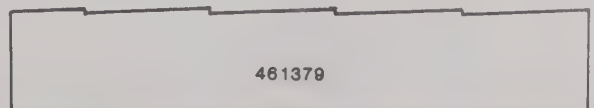


Figure 6-10. Hammer Alignment Tool

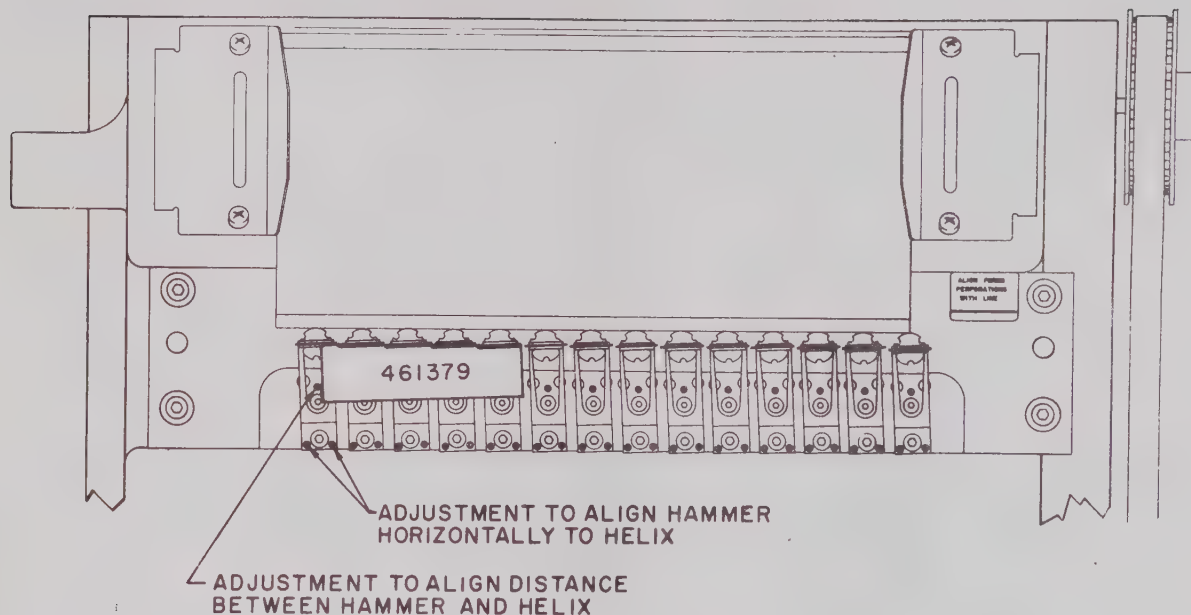


Figure 6-11. Hammer Alignment

lower cover/paper box to the enclosure.

4. Pivot the rear edge of the cover outward while simultaneously pushing the cover rearward. Pull the cover free.

5. Push the sensor lead wire connector A2 P3-4 and 8 from the body of connector.

6. Remove the two nuts holding the sensor in place on the paper box.

7. Mount the replacement sensor assembly on the paper box and secure with two nuts removed in step 6.

8. Perform steps 2 through 5 in reverse order.

9. Perform paragraph 6-5.

6-28. PRINTED CIRCUIT MODULES (7, 8, or 9, FIGURE 6-12). To remove interface card (7), print control module (8), or inverter card (9), perform the following:

Note

An inverter card is only used on printers utilizing primary power of 208V, 47-440 Hz, 3-phase wye and 28 VDC.

1. Set POWER switch to off.

Note

If the printer is rack mounted, perform paragraph 6-11, steps 4 and 5.

2. Remove 18 screws securing the electronics access cover to the enclosure (6), then remove the cover.

3. Remove six screws (7) securing the print control module (8).

4. Unplug connectors (2) from forward end of print control module.

5. Remove two screws from each hinge (3) and pull print control module (8) free.

6. Unplug connector A3P1 from interface card (7).

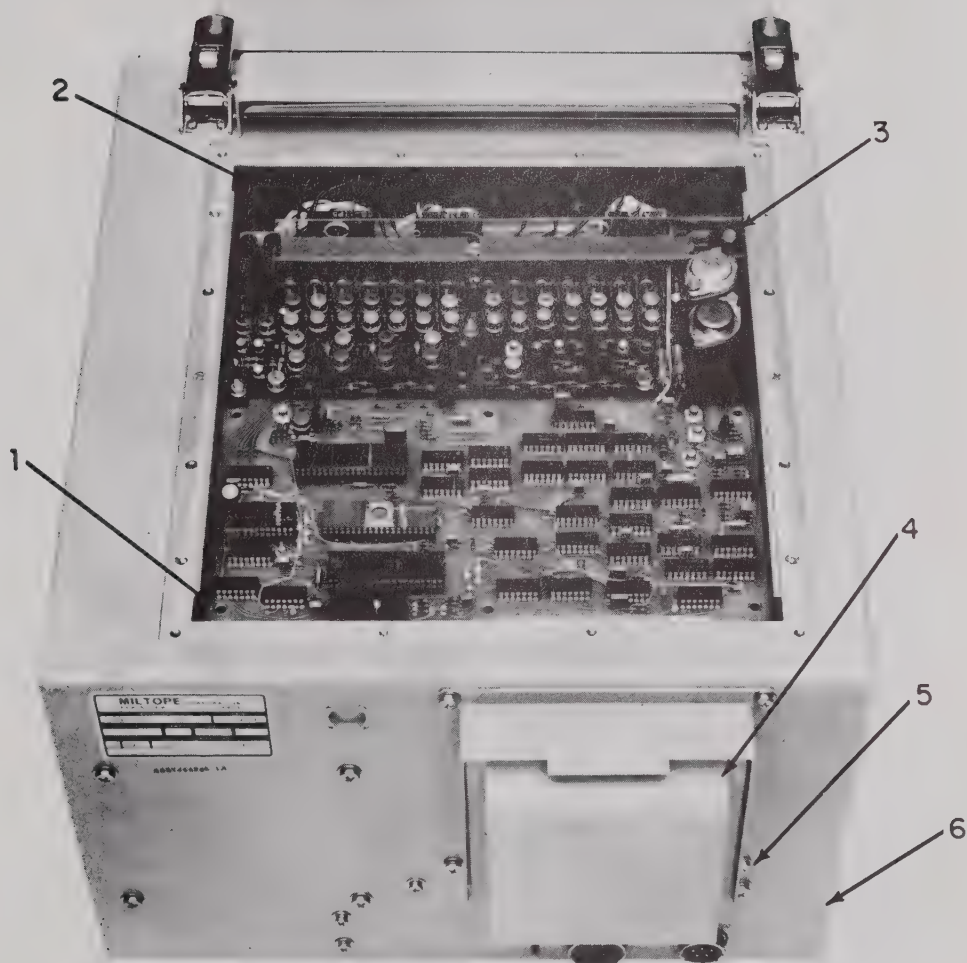
7. Remove six screws securing interface card (7) and remove the module from the printer.

8. Unplug connector A2P1 from inverter card (9).

9. Remove four screws securing inverter card (9) and remove module from printer.

10. Install replacement modules by performing steps 2 through 9 in reverse order.

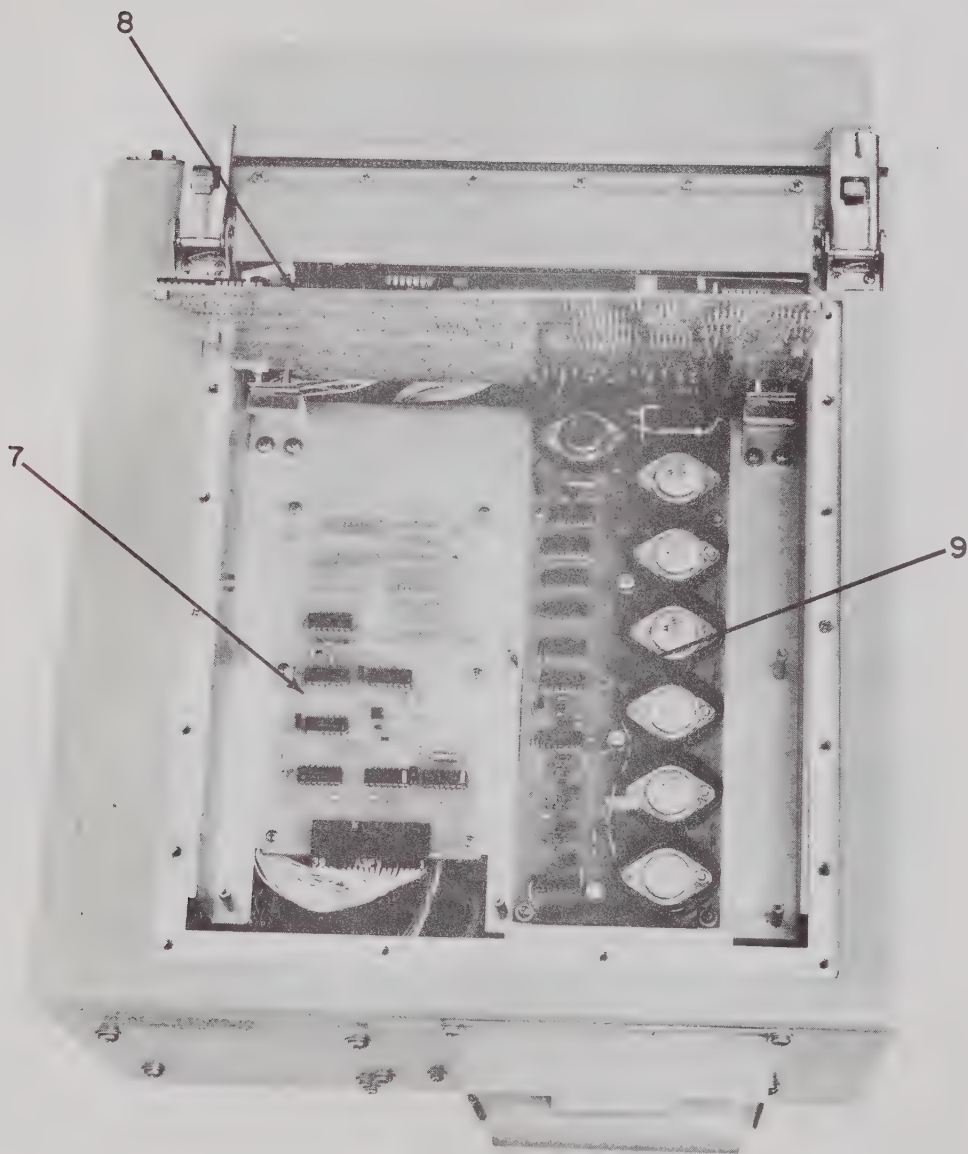
11. Perform paragraph 6-5.



LEGEND

- | | |
|----------------------|----------------------|
| 1. Retaining Screws | 4. Cooling Fan |
| 2. Hammer Connectors | 5. Fan Housing |
| 3. Hinge Screw | 6. Printer Enclosure |

Figure 6-12. Power Supply Enclosure Assembly (Sheet 1 of 2)



LEGEND

- | | |
|-----------------------|---|
| 7. Interface Card I/O | 8. Print Control Module
(Microprocessor) |
| 9. Inverter Card | |

Figure 6-12. Power Supply Enclosure Assembly (Sheet 2 of 2)

6-29. POWER TRANSFORMER. (1, FIGURE 6-13.) Perform the following:

1. Set POWER switch to off.
2. Remove printer from its mounting. (Refer to Section II.)
3. Remove power supply/enclosure lower cover by removing 14 screws.
4. Tag and disconnect transformer wire connections from terminal board TB1 terminals 1 through 13.
5. Remove two transformer mounting screws from rear of enclosure and two screws from right side of enclosure.
6. Work transformer (1) down and out through opening in the bottom of the enclosure.
7. Tag and disconnect leads from transformer and connect to replacement transformer.
8. Work replacement transformer into position through bottom of the enclosure and into position.
9. Secure transformer with hardware removed in step 5.
10. Connect transformer leads to terminal board TB1 and remove tags.
11. Replace lower cover.
12. Mount printer into position. (Refer to Section II.)
13. Perform paragraph 6-5.

6-30. RFI FILTER REPLACEMENT. (2, FIGURE 6-13.) Perform the following:

1. Set POWER switch to off.
2. Remove printer from its mounting. (Refer to Section II.)
3. Remove power supply/enclosure lower

cover by removing 14 screws.

4. Tag and disconnect leads from filter terminals.
5. Remove two screws securing filter to left side of enclosure and pull filter free.
6. Install replacement filter by performing steps 2 through 5 in reverse order.
7. Perform paragraph 6-5.

6-31. COOLING FAN. (4, FIGURE 6-12.) Perform the following:

1. Set POWER switch to off.

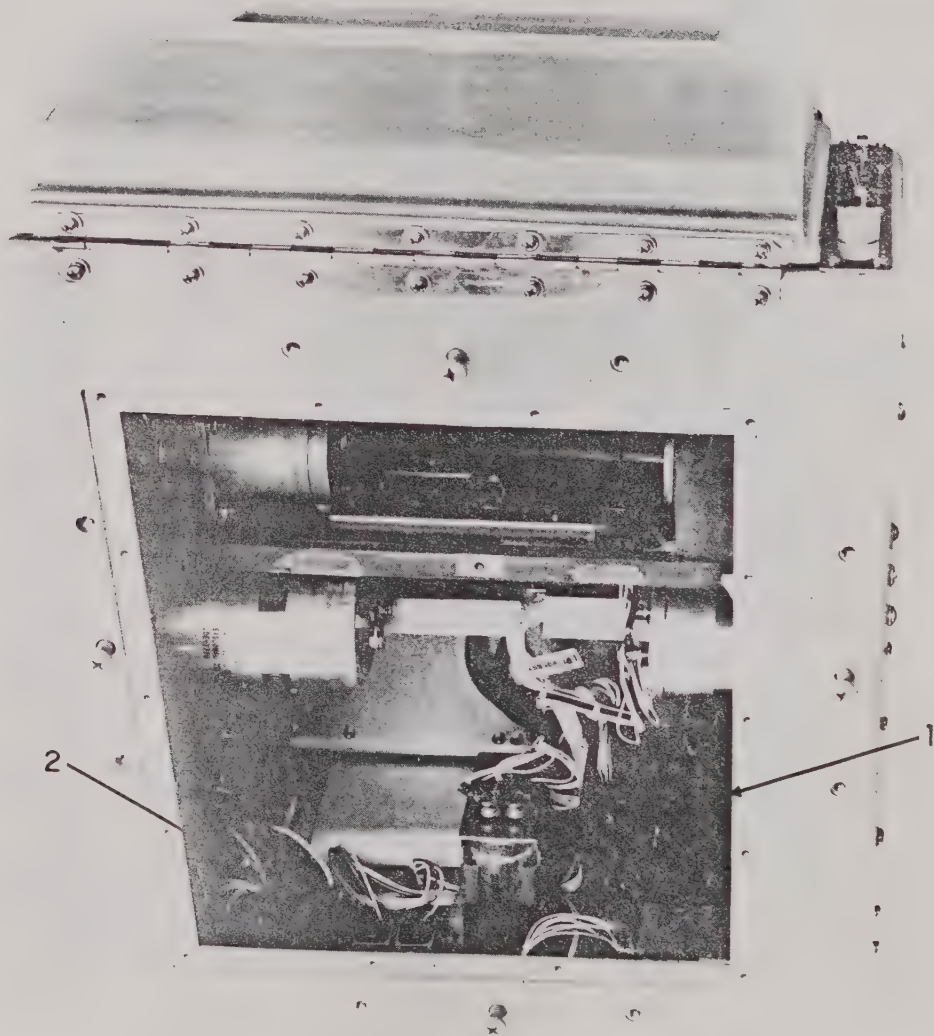
Note

If the printer is rack mounted, perform paragraph 6-11, steps 4 and 5.

2. Remove 12 screws securing the electronic access cover to the enclosure (6), then remove the cover.
3. Tag and disconnect leads from cooling fan (4).
4. Remove four screws securing fan housing (5) to rear of enclosure (6).
5. Pull fan and housing free of enclosure.
6. Remove four screws securing the fan mounting flange to the fan housing (5) and then remove fan.
7. Install replacement fan by performing steps 2 through 6 in reverse order.
8. Perform paragraph 6-5.

6-32. RECOMMENDED SPARE PARTS

6-33. Table 6-3 lists the recommended spare parts for various printer configurations.



LEGEND

1. Power Transformer

2. RFI Filter

Figure 6-13. Power Supply Enclosure Assembly, Lower Cover Removed

Table 6-3. Recommended Spare Parts List

PART NUMBER	DESCRIPTION	QUANTITY PER UNIT	USED ON MODEL HSP3609-212A-					
			X32049	X32054	X32066	X32088	X32120	X32183
461756	Air Filter Element	1	X		X	X		X
M210-588	Belt, Helix Drive	1	X	X	X	X	X	X
M210-590	Belt, Paper Feed	1	X	X	X	X	X	X
M57-7810	Bridge Rectifier, 100V, 50A	2	X		X			X
M57-7812	Bridge Rectifier, 200V, 5A	1	X		X			X
M57-7817	Bridge Rectifier Z1 (100V, 3 ϕ , 10A)	1		X				
M57-7821	Bridge Rectifier Z2 (100V, 3 ϕ , 25A)	1		X				
M57-7818	Bridge Rectifier Z3 and Z4 (100V, 3 ϕ , 5A)	2		X				
M25-19	Capacitor, Motor Start	2	X		X			X
M32-226	Capacitor, 1000 μ f, 10V	3		X				
M32-229	Capacitor, 4900 μ f, 50V	1	X		X			X
M32-230	Capacitor, 5800 μ f, 20V	1	X	X	X			X
M32-228	Capacitor, 22000 μ f, 25V	1		X				
M32-231	Capacitor, 64000 μ f, 20V	1	X		X			X
M225-11	E. T. Meter	1	X		X		X	
M209-3	Fan, Printed Wiring Assembly Cooling (400 Hz)	1		X			X	
456509	Filter	1	X		X			X
S137-5653	Fuse	1	X	X			X	X
M138-15	Fuse Holder	1	X		X		X	X
461379	Hammer Alignment Tool	1	X	X	X	X	X	X
462516-1	Hammer Assembly	14	X	X	X	X	X	X
460835 (Superseded by 462516-1)	Hammer Assembly							
460834	Helix Assembly	1	X	X	X	X	X	X
M206-72	Helix Bearing	2	X	X	X	X	X	X
S205-6293	Indicator Lens, Amber	1	X	X	X	X	X	X
S205-36	Indicator Lens, Green	1	X	X	X	X	X	X
S205-6294	Indicator Lens, Red	1	X	X	X	X	X	X
S205-6292	Indicator Lens, White	1	X	X	X	X	X	X
S205-6295	Indicator Socket	4	X	X	X	X	X	X
461564-1	Interface Printed Wiring Assembly (Modified NTDS)	1					X	
461272-2	Interface Printed Wiring Assembly (ROLM 3330)	1						
462664-1	Interface Printed Wiring Assembly (RL-6)	1	X					
463092-2	Interface Printed Wiring Assembly (RS232)	1			X			

Table 6-3. Recommended Spare Parts List (Cont)

PART NUMBER	DESCRIPTION	QUANTITY PER UNIT	USED ON MODEL HSP3609-212A-					
			X32049	X32054	X32066	X32088	X32120	X32093
463092-3	Interface Printed Wiring Assembly (RS232)	1				X		
463153-3	Interface Printed Wiring Assembly (Special)	1		X				
463156-2	Interface Printed Wiring Assembly	1		X				
M204-23	Lamp	4				X		
S204-6314	Lamp	4	X	X	X		X	X
S45-1380	Line Filter	2		X				
S45-1394	Line Filter	2	X		X			X
M72-427	Mating Connector, Paper T/U, MS3116F-8-4S	1				X		
M71-48	Mating Connector, Power, MS27473E14A5S	1	X		X		X	X
M71-45	Mating Connector Signal, MS27473E18F53S	1	X		X		X	X
460940-1	Motor Assembly, Blower	1	X		X	X		X
463233	Motor Assembly, Blower	1		X				
456519	Motor Assembly, Helix Drive (400 Hz)	2					X	
460933	Motor Assembly, Helix Drive	1	X		X	X		X
463234	Motor Assembly, Helix Drive	1		X				
460946-1	Motor Assembly, Stepper	1	X		X	X	X	X
462982	Stepper Motor Assembly	1		X				
460811	Paper Drive Wheel	2	X	X	X	X	X	X
460889	Paper Low Assembly	1	X		X	X	X	X
463239	Paper Low Assembly	1		X				
461024-1	Paper, Single Ply, Pressure Sensitive, 9-3/8" x 11"	A/R	X		X	X	X	X
461024-2	Paper, Two Ply, Pressure Sensitive, 9-3/8" x 11"	A/R	X		X	X	X	X
461024-3	Paper, Three Ply, Pressure Sensitive, 9-3/8" x 11"	A/R	X		X	X	X	X
461024-4	Paper, Four Ply, Pressure Sensitive, 9-3/8" x 11"	A/R	X		X	X	X	X
461024-5	Paper, Five Ply, Pressure Sensitive, 9-3/8" x 11"	A/R			X			
462769-1	Paper, Single Ply, Pressure Sensitive, 9-3/8" x 7"	A/R		X				
462769-2	Paper, Two Ply, Pressure Sensitive, 9-3/8" x 7"	A/R		X				
462769-3	Paper, Three Ply, Pressure Sensitive, 9-3/8" x 7"	A/R		X				
462769-4	Paper, Four Ply, Pressure Sensitive, 9-3/8" x 7"	A/R		X				

Table 6-3. Recommended Spare Parts (Cont)

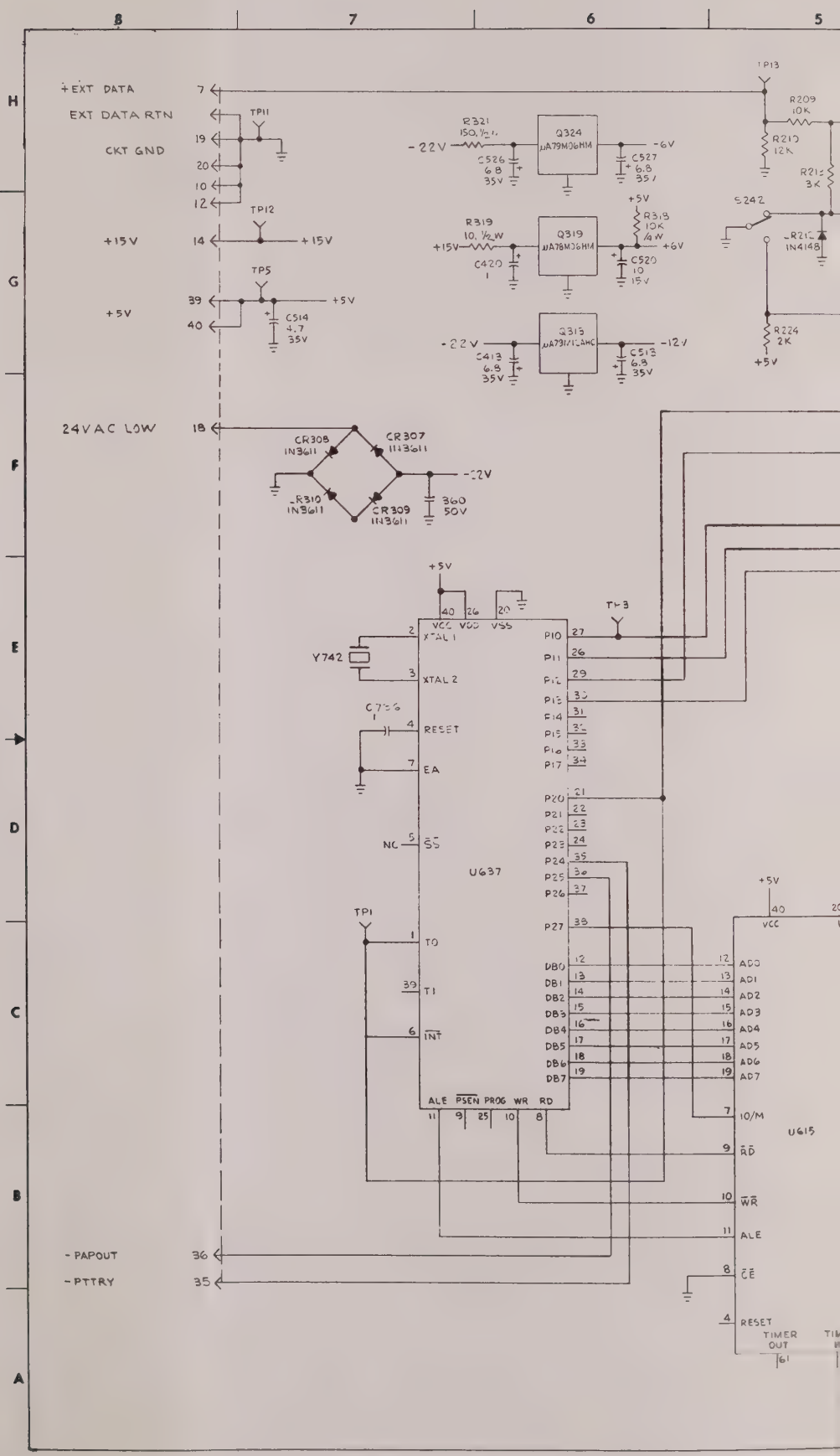
PART NUMBER	DESCRIPTION	QUANTITY PER UNIT	USED ON MODEL HSP3609-212A-					
			X32049	X32054	X32066	X32088	X32100	X32098
461362	PCB Extender Cables	-	X	X	X	X	X	X
M215-17	Pinch Roller	2	X	X	X	X	X	X
460872-7	Power Printed Wiring Assembly (80/132 Col.)	1						
462684-2	Print Control Printed Wiring Assembly	1		X				
462684-3	Print Control Printed Wiring Assembly	1						
462684-4	Print Control Printed Wiring Assembly	1			X			
462684-5	Print Control Printed Wiring Assembly	1				X		
462684-6	Print Control Printed Wiring Assembly	1	X					
462684-7	Print Control Printed Wiring Assembly	1						X
462757-1	Relay Assembly (60 Hz)	1	X		X	X		X
462757-2	Relay Assembly (400 Hz)	1					X	
M232-12	Shock Isolator, Front	2	X	X	X	X	X	X
M232-11	Shock Isolator, Rear	2	X	X	X	X	X	X
TE-905	Simulator and I/O Cable	1	X	X	X	X	X	X
460941	Switch Assembly, Paper Out	1	X	X	X	X	X	X
M62-31	Switch (Lamp, 80/132)	2	X	X			X	
M62-41	Switch (Test/Form Feed, Slew/5 Line)	2	X	X	X	X	X	X
M62-38	Switch, Power	1	X		X		X	X
460828	Timing Wheel (80 Column)	1	X	X	X	X	X	X
461376	Timing Wheel (132 Column)	1	X	X	X	X	X	X
460817	T.O.F. Assembly	1	X		X	X	X	X
462947	T.O.F. Assembly	1		X				
461124-1	Transducer Assembly (80/132 Column)	1 or 2	X	X	X	X	X	X
460777-1	Transformer Assembly	1	X		X		X	X
463577-1	Transformer Assembly	1		X				
460909	Window, Front Door	1	X		X	X	X	X
M315-8	Slide	1	X		X			X
M315-9	Slide	1	X		X			X
462684-10	Print Control PWA	1					X	

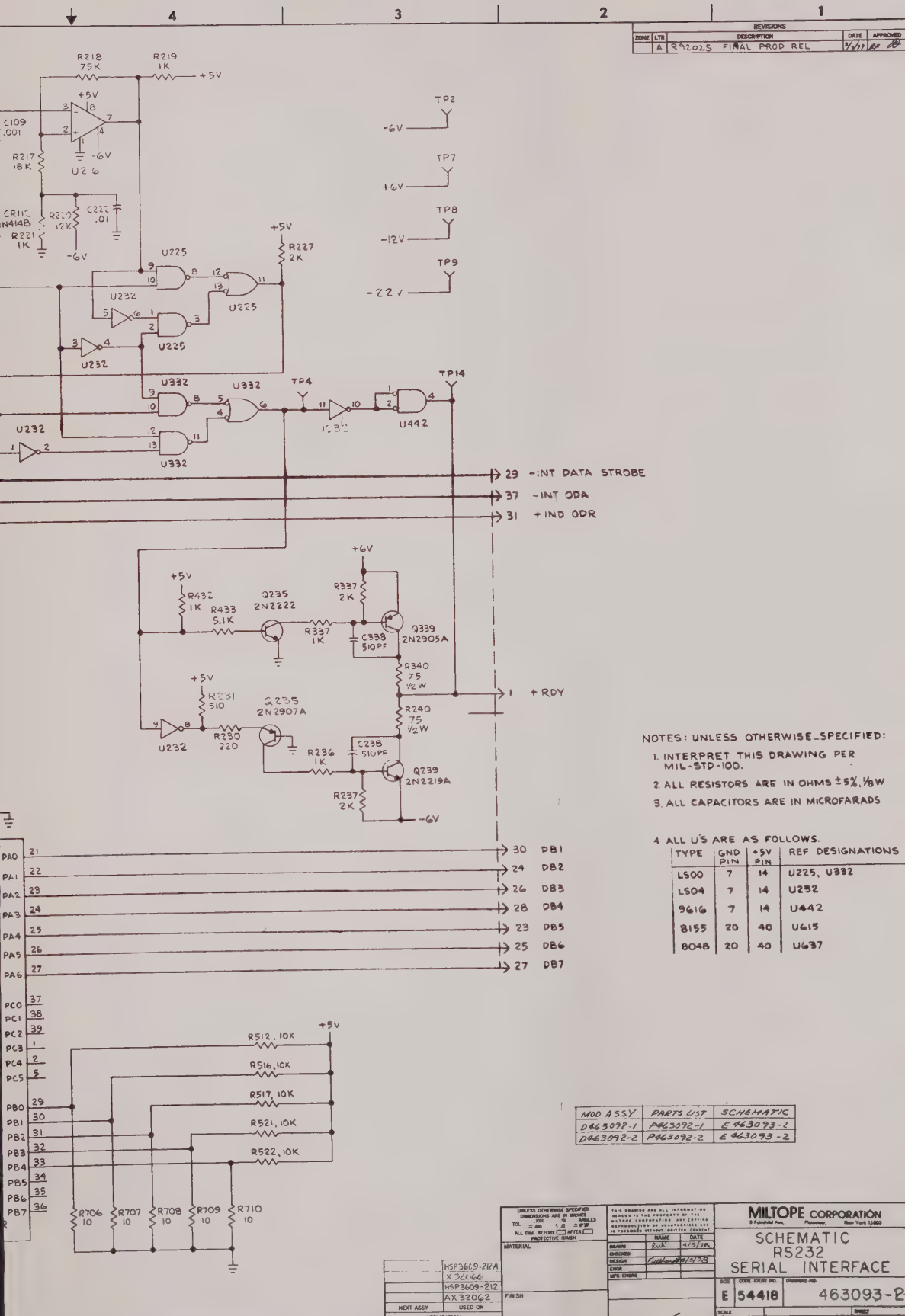
SECTION VII
SCHEMATIC DIAGRAMS

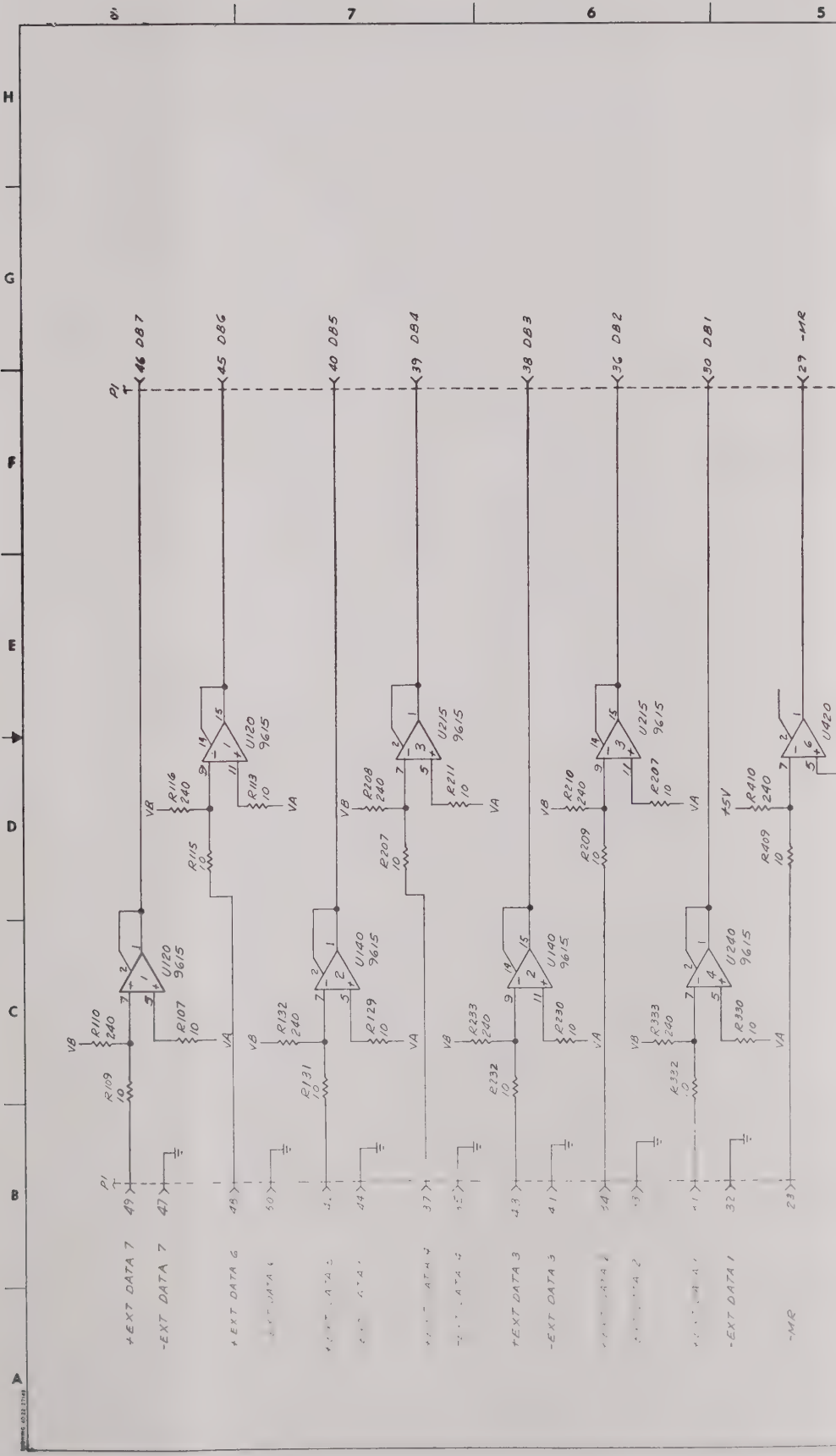
- 7-1. GENERAL of the printer and various interfaces. Table 7-1 lists the figure number, title, and Miltope drawing number for each schematic diagram.
- 7-2. This section contains schematic diagrams

Table 7-1. Schematic Diagrams

FIGURE NUMBER	TITLE	DRAWING NUMBER
7-1	Schematic, RS232 Interface	463093-2
7-2	Schematic, TTL Interface	461273-2
7-3	Schematic, NTDS Interface	461565-1
7-4	Schematic, RL-6 Interface	462665-1
7-5	Schematic, ROLM 3330 Interface	461273-3
7-6	Schematic, PDP-11M Interface	461575-1
7-7	Schematic, Inverter Board	463157-2
7-8	Schematic, Print Control Board	462685-4
7-9	Interconnecting Diagram	461849
7-10	Interconnecting Diagram, Model HSP 3609-212AX32302	473202







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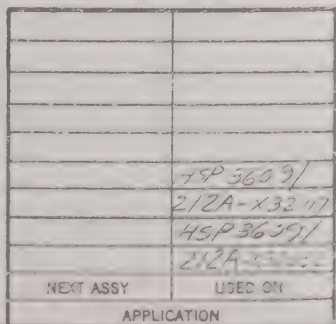
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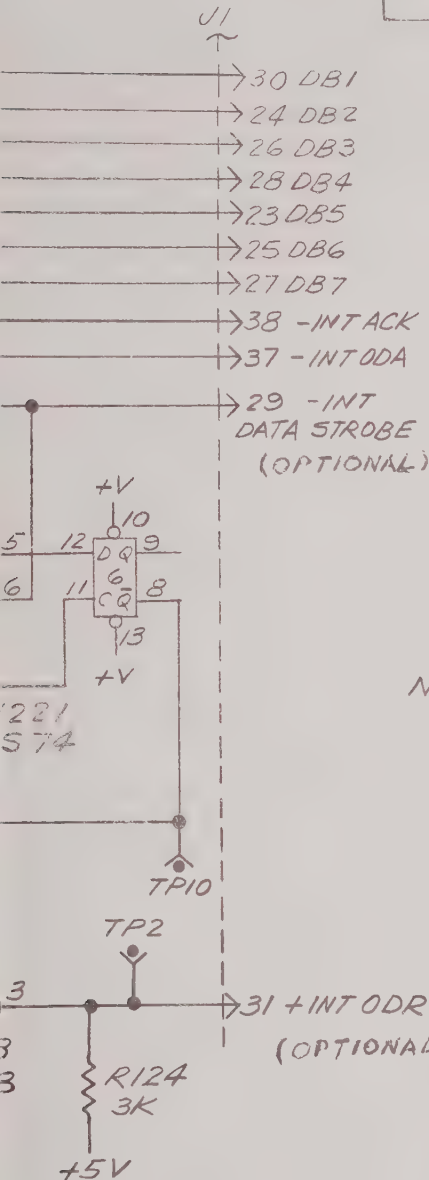
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2. ALL RESISTORS ARE IN OHMS $\pm 5\%$ $\frac{1}{8}W$

3. ALL CAPACITORS ARE IN MICROFARADS $\pm 10\%$

4. ALL U'S PIN 7 IS GND AND PIN 14 IS +5V. EXCEPT U309 AND U409 PIN 8 IS GND, PIN 9 IS -6V AND PIN 16 IS +5V.

5. PARTIAL REF DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATIONS USE PREFIX A3.

PREFIX	PW ASSEMBLY	PARTS LIST	SCHEMATIC
A3	D461564-1	P461564-1	C461565-1

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SCHEMATIC DIAGRAM
INTERFACE

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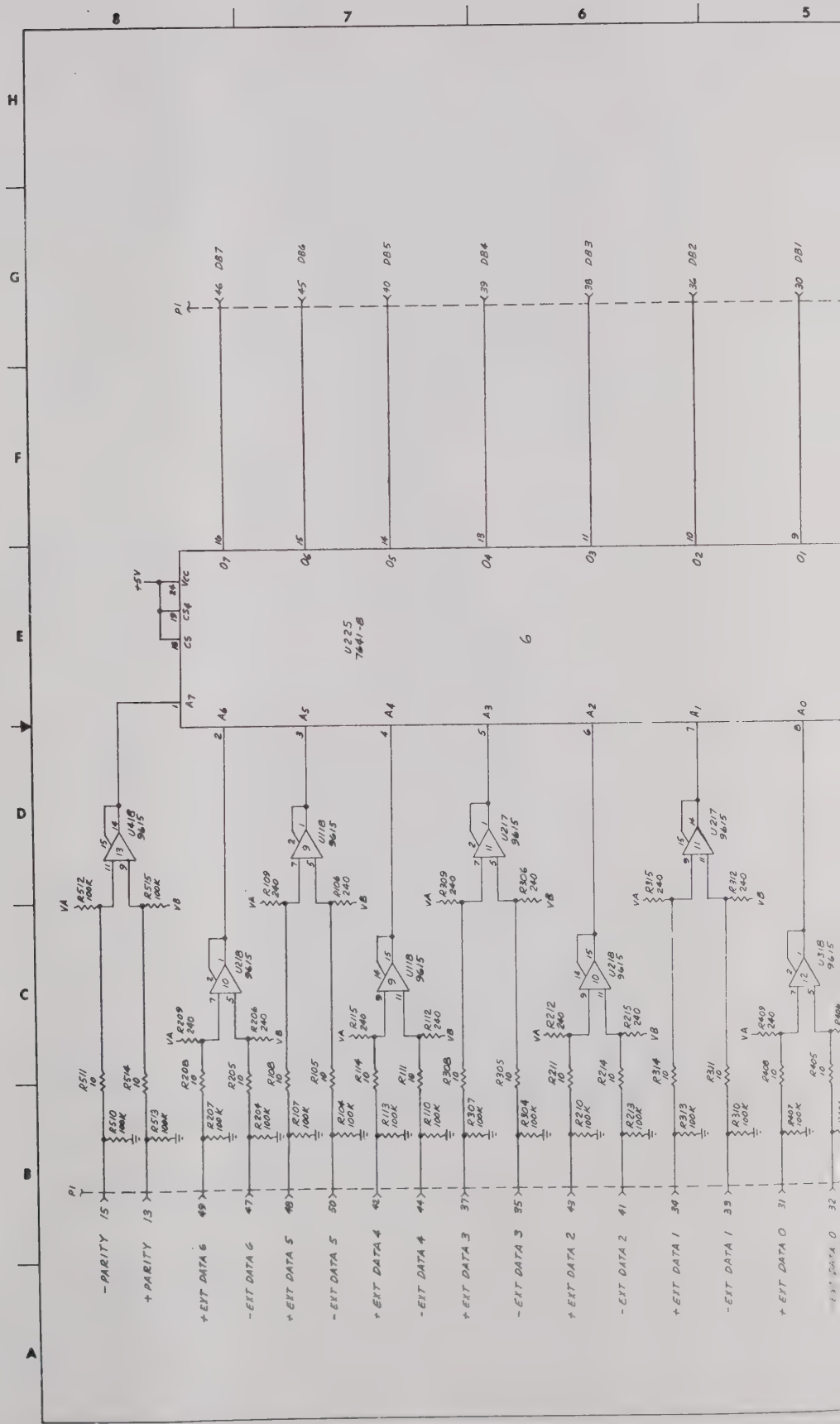
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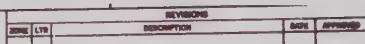




1. ALL RESISTORS ARE IN OHMS, $\frac{1}{2}W$, $\pm 5\%$
2. ALL CAPACITORS ARE IN UF.
3. ON U116, U218, U125, U225, U318, U418, U425, U310 PIN 7 IS GND & PIN 14 IS +5V.
4. ON U410 PINS 1, 8 & 15 ARE GND & PIN 16 IS +5V.

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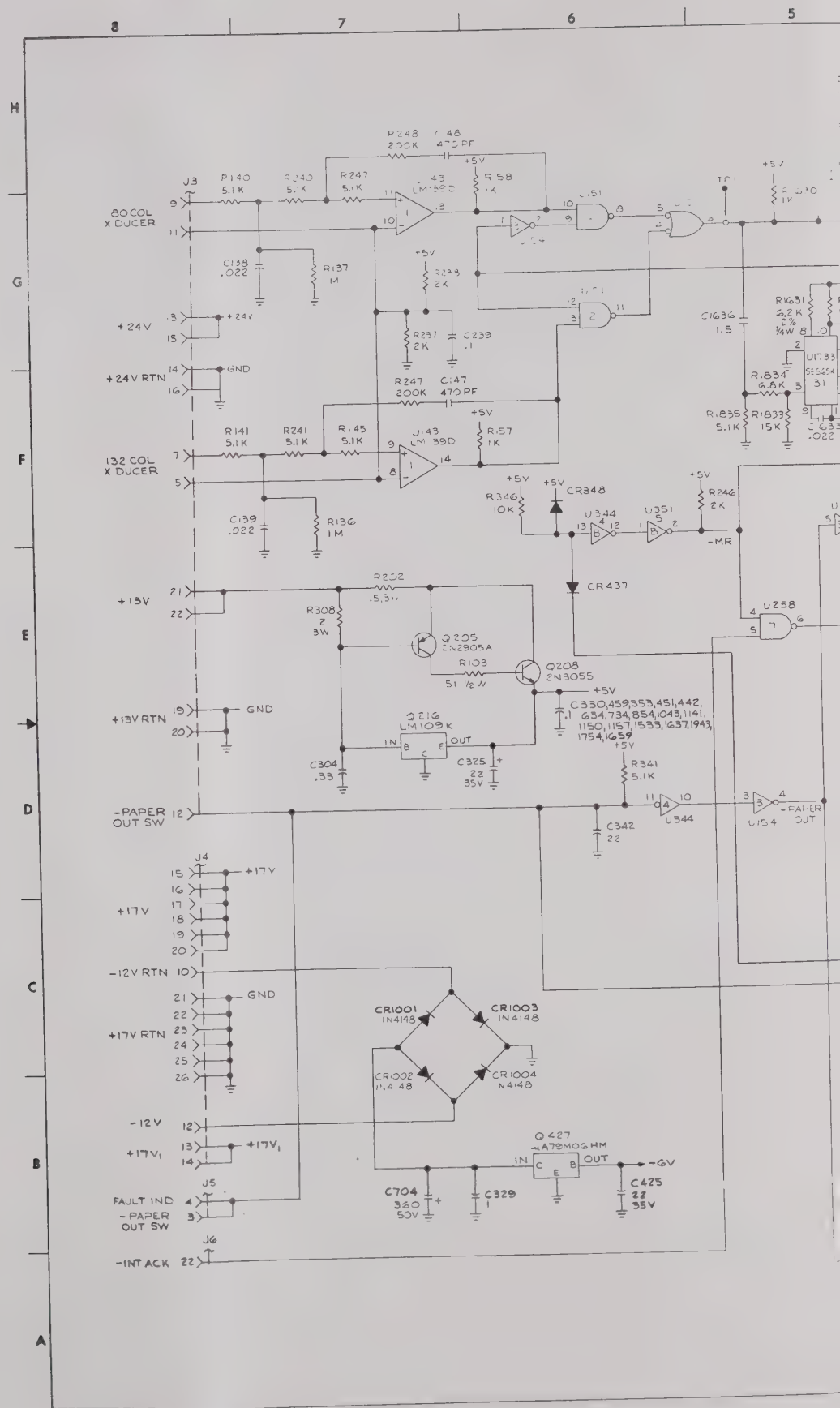


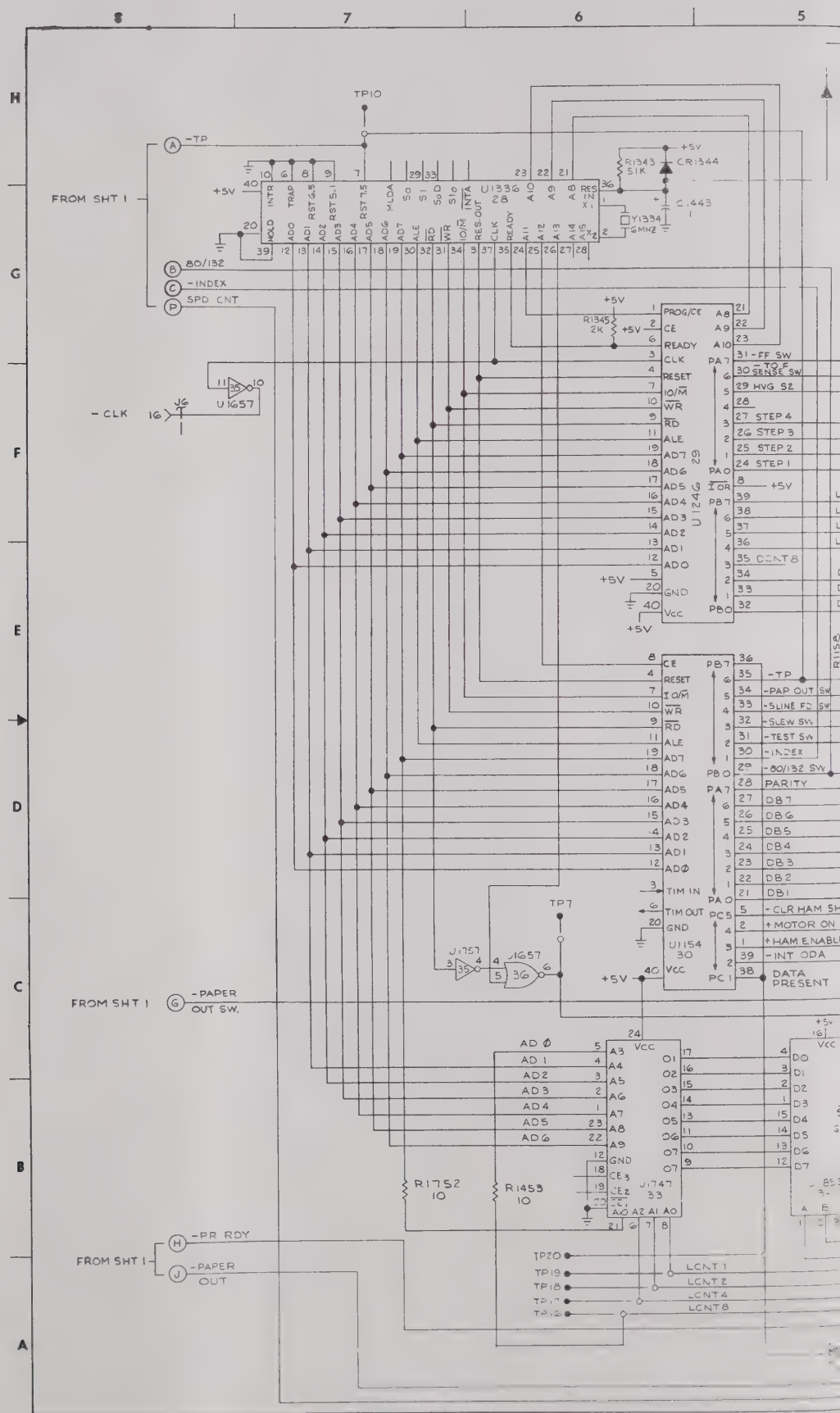
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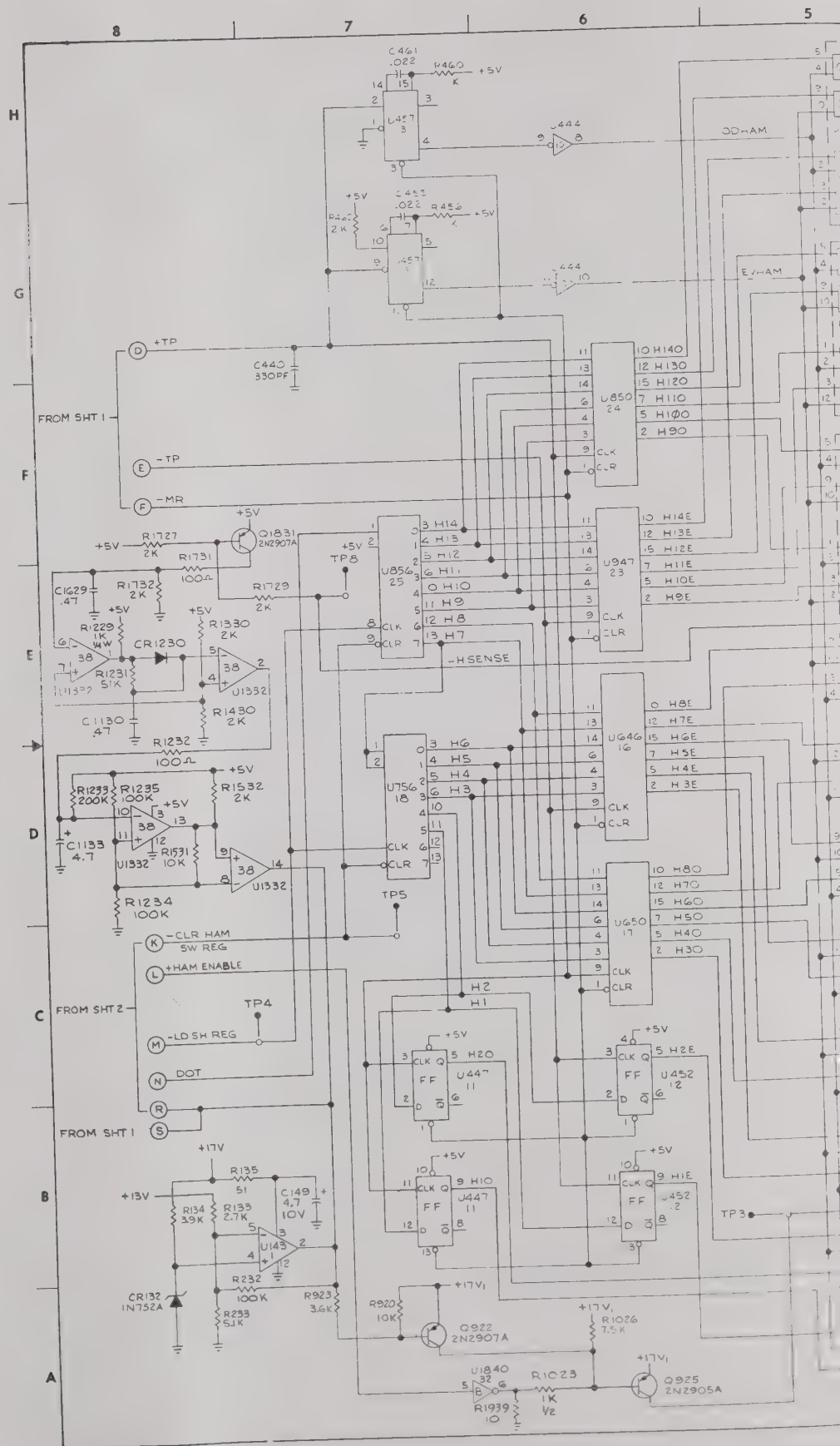
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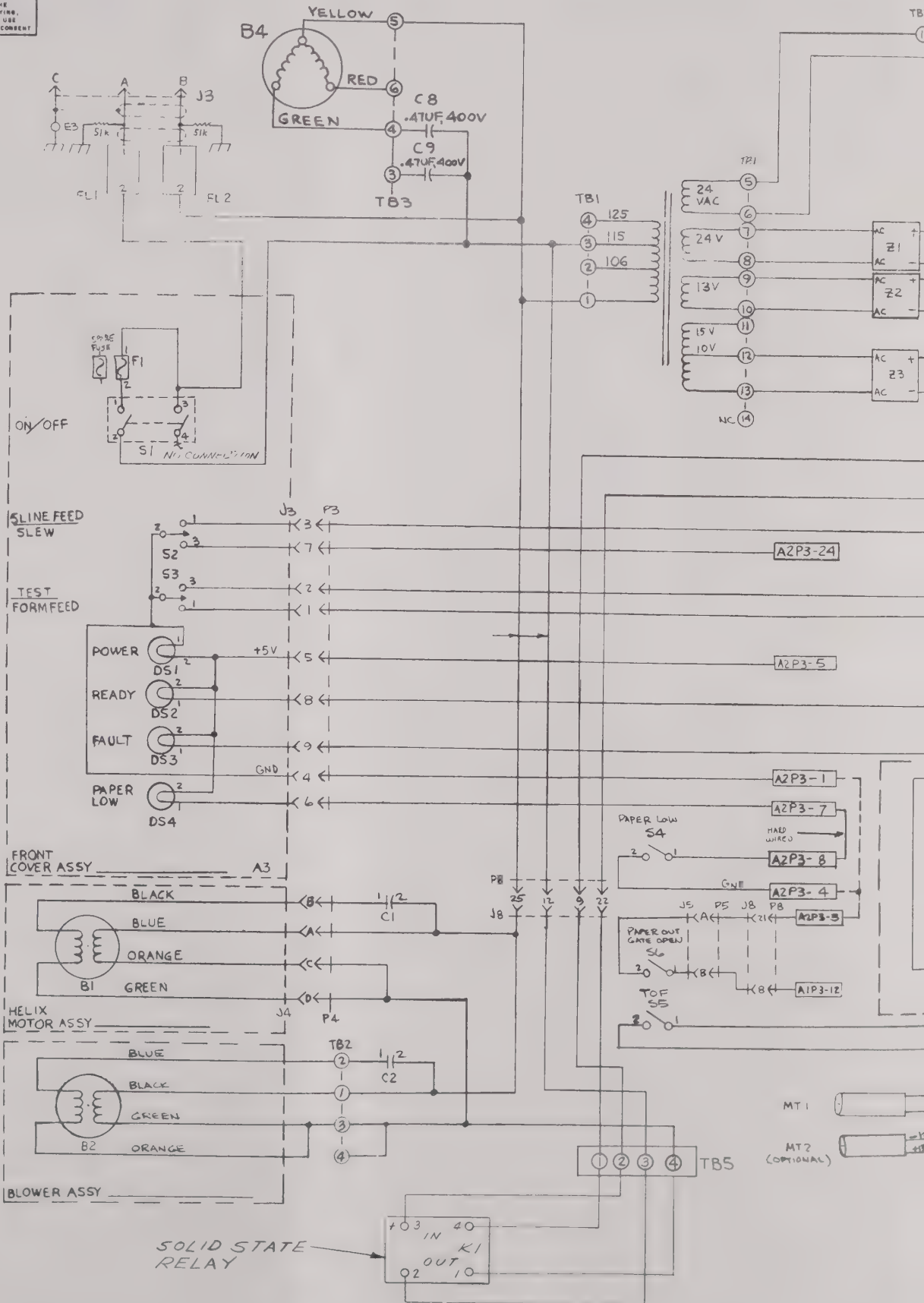
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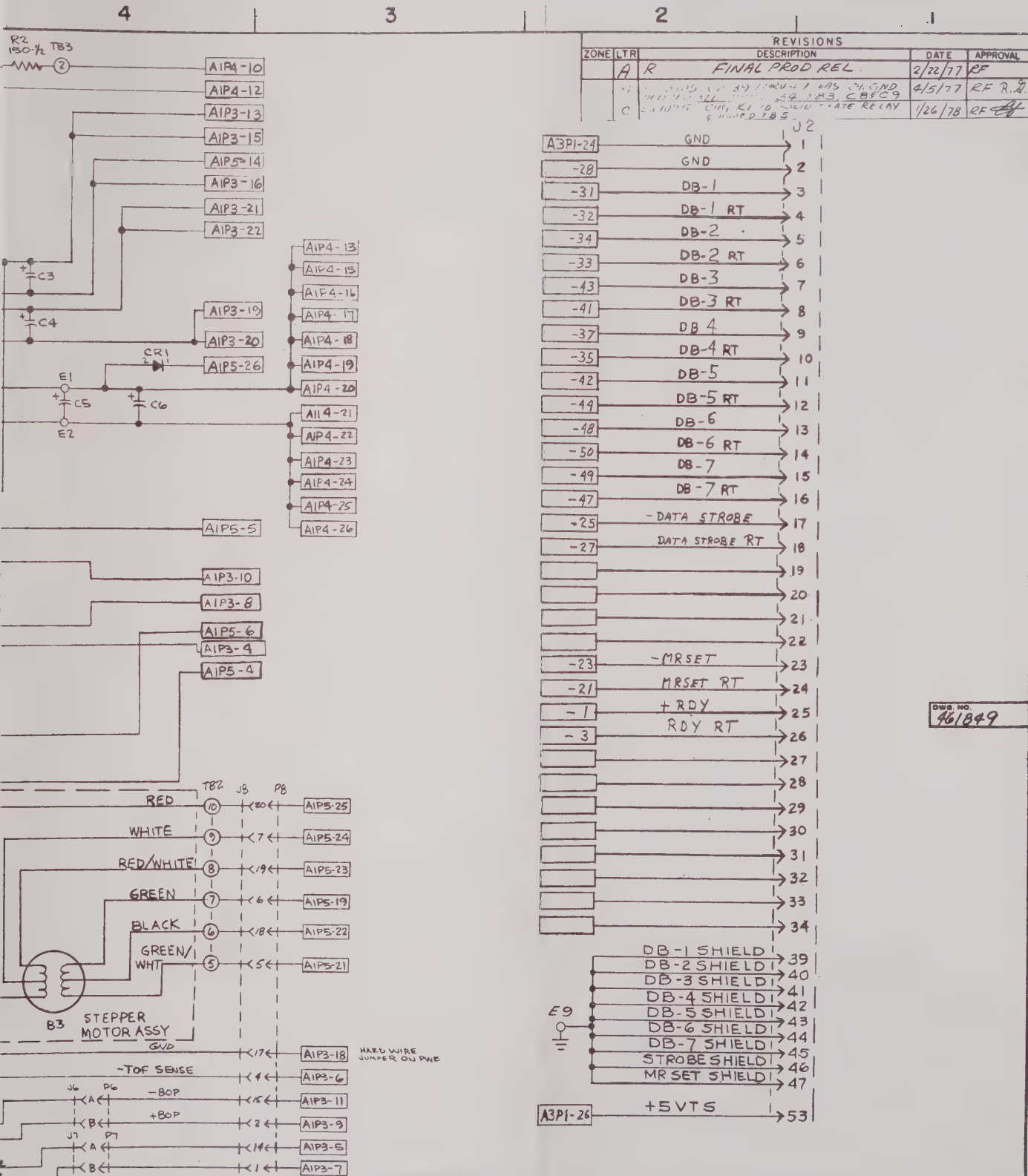






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